THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXIX. No. 6. Whole No. 1,470. | NEW YORK, MONDAY, AUGUST 10, 1903. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office for subscriptions advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—
Briefly Told 201
Notes.
*The Fuel Oil Boom that Followed Scarcity of Coal: Its Effect in America and Elsewhere, by "An Exile" 202
The Valuation of Gas Coals 203
*Newman's Time Light Controller 205
The Teaching of Physics to Engineering Students, by Mr. W. S. Franklin 206
*The Mechanical Cause of Gravity, by Mr. Robt. Stevenson. 207
*A Heavy Service Lathe with Electric Drive 210
ITEMS OF INTEREST FROM VARIOUS LOCALITIES 212
Changes at Circleville, O.—To Go Ahead at Corona, Cal.—Aledo (Ills.) Wants a Gas Plant—Executive Management, Lancaster, Pa.—Annual Meeting, Boone, Ia.—Something from Taunton, Mass.—Gas Works for Calgary, N. W. T.—Orders from the Board—Something from Alton, Ills.—Mr. Frost is Warming to His Work—A Hint from Fall River, Mass.—"Speckles" from San Francisco—Something from Milwaukee, Wis.—Mr. E. G. Runyan Presents Some Figures—Pittsfield, Mass., Makes a Report—And Other Items.
The Market for Gas Securities 214

BRIEFLY TOLD.

NOTES.—

MR. ROBERT SIMONDS, formerly of Napa, Cal., has been appointed Superintendent of the electric lighting division of the business of the Mendocino Lighting Company.

A WELL-KNOWN gas man, who wishes to remain "unsigned" in this instance, forwards the following—he was summering in the named house at the time the discovery was made: "The gasoline gas plant of the Seashore House, one of the best known hotels at Old Orchard Beach, Me., gave the proprietors much trouble early in the season. The pressure was altogether insufficient, and candles had often to be resorted to for the fair lighting of the rooms. The machine (it is of a well-known standard type) was examined several times, but nothing definitely wrong could be discovered about it. Finally, Proprietor Staples determined to go 'to the root of the matter,' as he expressed it, and accordingly the apparatus was taken apart. Noticing a bit of straw protruding from the air supply pipe the lead was followed, and at about an arm's length from the tank inlet was discovered a sparrow's nest. The rest was easy."

AT the annual meeting of the Greenville (O.) Gas Light Company the following officers were elected: Directors, W. T. Morris, Daniel Morris, T. S. Atkinson and H. C. Glenn; President and Treasurer, W. T. Morris; Secretary and Superintendent, Daniel Morris.

THE Messrs. Rockwell have determined to virtually construct a new plant for the supply of gas to the residents of Negaunee, Mich.

THE New Process Stove Company, to manufacture gas cooking and heating stoves, will build a well equipped factory at Mansfield, O. Messrs. Berry Baxter and E. C. Baxter are the main parties in interest.

SUPERINTENDENT J. A. HODGSON says that the improvements on the plant of the Athens (O.) Gas Company will be completed by October 1st. An increase of 75 per cent. in the generating capacity will enable him to live in peace during the time of heavy output next winter.

WE regret to be called on to chronicle the death of Mr. Walter Fishbach, the office manager of the Dayton (O.) Gas and Fuel Company, whose demise occurred the morning of the 29th ult. He was in his 32d year.

THE meter readers in the employ of the Laclede Gas Light Company, of St. Louis, now wear uniforms of blue cloth. The cap carries the inscription, "Laclede Gas Light Company." All other employees of the Company, whose duties oblige them to enter the premises of consumers, are equipped with a numbered metal badge.

CONSTRUCTION work on the plant of the Laramie (Wyo.) Gas Light and Fuel Company is underway. Those in charge of it declare that Laramie will have gas by December 1st.

MR. J. HENRY HALBURG has been appointed General Superintendent of the electrical division of the plant of the Cincinnati Gas and Electric Company.

THE proprietors of the Cambridge (Mass.) Gas Light Company have purchased a large plot of land on the north side of Broad Canal, near Third street. This purchase presages likely the reconstruction of its works.

LIBRARY OF CONGRESS. AUG 10 1903 SMITHSONIAN DEPOSIT.

THE Brainard faction have at last succeeded in purchasing control of the Carthage (Mo.) Light Company from Mr. George M. Meyers, of Kansas City, Mo. Mr. J. M. H. Young, of Joplin, Mo., succeeds Mr. J. H. Enright as Superintendent at Carthage.

AT the annual meeting of the New Bedford (Mass.) Gas and Edison Light Company the following officers were elected: Directors, H. G. Howland, Thos. H. Knowles, Charles R. Price, George R. Stetson, Chas. H. Lawton, Frederic Taber, Andrew G. Pierce, Oliver Prescott, Jr., John S. Perry, Henry M. Knowles and L. B. Bates; Treasurer and Clerk, Charles R. Price.

A RECENT issue of the New York *Times* declared that the new Edison storage battery is now ready for commercial use, all the tests applied to it having proven its reliability. It has been for some weeks in a department store delivery wagon in this city, having displaced one of the old type of battery, and has exceeded the guarantee given for it. The old battery weighed 1,260 pounds and had an endurance of 25 miles only. The Edison battery weighs 650 pounds and has a life of 37 miles. The inventor made a run to Atlantic City recently over the roughest road that could be found—about 100 miles—without mishap, and also went up Eagle Rock in the Oranges, near Newark, with no difficulty whatever; this is one of the heaviest grades in the vicinity. Edison asserts that next year he will go to Chicago at an average speed of 25 miles an hour without a breakdown. The batteries are made at present for 25, 50, 75 and 100 miles endurance, but can be made larger or smaller. Only one a day can be made with the present facilities, but these last will be increased to supply all demands.

MESSRS. E. B. MEGINNIS and Jas. W. Chapman, Jr., of Baltimore, Md., representing Mr. N. T. Meginnis, of the same city, have been granted a franchise under which it is proposed to construct and operate a gas works in Chestertown, Md.

THE selling rate at Indianapolis, Ind., has been reduced to 95 cents per 1,000 cubic feet, the per annum output having reached the 300 million mark.

THE Berwick (Pa.) Gas Supply Company has purchased a site for its plant. No time will be lost in completing the work of construction.

THE following from a recent issue of the New York *Herald* explains itself: Shareholders of the Consolidated Gas Company of this city will at a very early date be offered the privilege of subscribing to approximately $6,000,000 of treasury stock, which the Company will offer on a certain percentage to present holders at $150 a share. The total amount of fresh capital to be raised, about $9,000,000, will be payable at one time, on September 15 next. Only very meager details could be obtained in the financial district yesterday concerning the plans of the Company in connection with the new stock issue, but the $9,000,000 or thereabouts which is to be raised will be expended in connection with the Company's plans for removing its plant from New York city to Lawrence Point, L. I., on the Hell Gate shores of Long Island Sound.

"The Consolidated Gas Company has very extensive and comprehensive plans for the improvement of its plant. These embody the abandonment of three sites on Manhattan Island and the transferrence of its manufacturing plant to the Long Island shore, from which gas will be sent to New York through the tunnel between this city and Ravenswood. When completed the new gas plant will be up to a production of perhaps 200,000,000 cubic feet per day. The various improvements planned by the Consolidated Gas Company will involve heavy expenditures, some of which have already been incurred. It is to provide for the settlement of some proportion of this that the present sale of treasury stock has been authorized. The authorized capital stock of the Consolidated Gas Company is $80,000,000, of which, according to the *Commercial and Financial Chronicle*, $6,822,900 is in the treasury. In recent years, almost entirely for the purpose of acquiring property, the stock of the Company has increased rapidly. Prior to March, 1900, the capital was $39,078,000. It was increased to $54,595,200 at that time in order to complete the purchase of the New York Gas, Electric Light, Heat and Power Company. In July, 1900, a further increase to $80,000,000 was authorized, and all but about $7,000,000 issued, to acquire the New Amsterdam Gas Company and the Standard Gas Light Company, terminating thereby the famous gas war, which waged in the city for many months during 1899 and 1900. In addition to its present authorized capital stock issue of $80,000,000, the Consolidated Gas Company has, together with that of its controlled gas and electric light and power companies, a funded debt of $72,188,391. As already stated the treasury stock will be offered at $150, which is the same price at which the Company, in 1900, sold its last previous issue."

The Fuel Oil Boom that Followed Scarcity of Coal: Its Effect in America and Elsewhere.

By "AN EXILE."

The coal strike of the winter of 1902 had more to do with the introduction of fuel oil in a practical way than is usually supposed. The effect of the oil boom which accompanied the coal strike was felt throughout the world, because other countries realized that there might come a time when coal would be impossible to obtain, and that oil fuel would have to be relied upon. The result was that steps were taken to overcome the troubles, delays and non-supply of fuel of a coal famine, by retaining in service such apparatus and devices as would operate with oil fuel. Oil fuel has been experimented with to a greater extent in America and other countries since the coal famine than ever before, and it is a fact that there are thousands of shops and mills and hundreds of thousands of families now utilizing oil fuel because of the event which caused them to turn from coal to oil as a more reliable supply at moderate cost. I have interviewed inventors of devices for generating power with oil heat, cooking oil fuel contrivances and varied apparatus for using oil fuel for different lines of mechanical work, and discovered that very many heretofore unserviceable machines have been brought into active service through demand. Devices for power purposes, cooking, lighting, etc., have been demanded in large numbers, with the result that the inventors and manufacturers were encouraged to resurrect all manner of discarded ideas along the oil fuel burning line and get them put into serviceable order for the machines and devices of the markets. The boom caused many a poor inventor of oil burning apparatus to reap a fortune.

In the Sales' Department.—Taking the oil boom and the following data in order, we find that, first of all, the coal famine of America produced a stimulated oil fuel market that will last for a long time, and perhaps indefinitely, not only in the United States markets but elsewhere. Your correspondent found that foreign inventors and builders of oil burning and heating devices were doing a rich trade in devices ordered for shipment to the American markets to replenish depleted stocks of oil fuel stoves, furnaces, boiler equipments, etc. The result of the draft upon the foreign markets was the stimulation of building more machines and the invention of new and improved ones. The consequence is that the shops of America, England, Germany, Russia, Spain and other countries have produced extensively oil fuel contrivances. The demand in these countries for oil fuel stoves and boiler outfits for machine plants is very much greater than formerly, for the reason that the housewife and the managers of the power plants argue the necessity of having on hand, in case of emergency, devices which will operate with oil fuel in the event of a coal famine such as was experienced in America. I noticed the activity in the sales' departments of all oil handling establishments and remarked on the ingenious devices used for drawing trade. In Fig. 1 is shown one of the advertising contrivances typical of the class made by the oil salesmen during spare hours, using odds and ends of stuff from about the store or shop. This consists of a display of a large lump of coal fixed on the disk of the affair, which is set up on a shaft and fitted with a spiral spring and adjusted in cross boards, as shown. On the opposite end is a can of fuel oil such as they use in foreign markets for selling a few quarts of fuel oil to the poorer classes of people who buy a little at one time. This can is similarly set on a disk and piston with spiral spring. The affair is set up in the window where the oil cases and cans are exhibited for sale. The least jar of the flooring causes the springs to produce the necessary vibration on the lump of coal and jar of oil to make a curious effect. Often when a heavy team passes the vibration transmitted is such that both coal and can bob up and down quite perceptibly. The idea of the scheme is merely to let the purchasing public observe that "We sell fuel oil."

Opened a Big Trade for Canvassers.—The oil fuel boom in America not only opened a big sale for all stores, mills, refineries, wholesale departments and grocers, for fuel oil in the United States, but likewise opened the way for drummers to handle oil samples as they never handled them before in all the commercial centers of the world. For instance, your correspondent met with fuel oil agents in foreign lands, where these agents would say to prospective purchasers, "Look at the situation in America! Coal $15 a ton; and scarce at that. Coal famine may occur anywhere. Better let me fit you out with an oil fuel stove (or engine furnace, as case may be), so you will be prepared for any emergency." All this may seem queer; but it is the fact that these canvassers of modern oil fuel burning devices and sellers of oil fuels in bottles, cans and barrels, did and are doing an excellent business in for-

eign sections because of the coal troubles in the United States of America.

It was an Object Lesson.—The coal famine was an object lesson to the world. It taught consumers of power a lesson to be ready with oil fuel devices the moment that coal gave out, and it demonstrated to the housewife the need of having something in the house to cook with besides a coal burning stove. The coal famine developed many oil fuel salesmen who are still in the business and who have undertaken the sale of fuel oil in a systematic way. Fig. 2 is a drawing of one of the handy little cases I noticed. Sample bottles of oil of different grades and value are carried in the case, with necessary small sized lamps or oil fuel burning arrangements, so as to practically illustrate the character of the heat and flame produced by burning the oil. I likewise noticed that signs of varied extent and design were freely introduced by the oil dealing concerns during the famine in coal, and that many of these signs are still doing duty indicating the continuance of the trade. Fig. 3 is a typical pattern of sign used.

For Oil Distribution.—The devices which have sprung into existence for conveying oil fuel from house to house for oil burning stoves and for the small horse power boilers of the manufacturing and industrial concerns, have been very numerous. Fig. 4 shows one of the cylindrical devices on wheels which I observed was used effectually. It is a light device, and handled by one man. It holds about three-quarters of a barrel of oil. The vendor wheels the cylinder cart about and sells oil at retail. In foreign countries the vendors of oils use tubes of the sort shown in Fig. 5 very often, and the same is carried by a rope passed above the shoulders. I saw some pottery affairs, like that in Fig. 6, utilized for holding oil and employed in the markets for the distribution and sale of same.

Oil Supply Tanks for Home Use.—The plumbers and pipefitters the

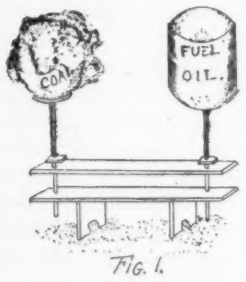


Fig. 1.

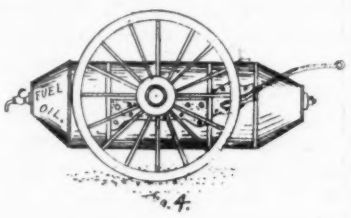


Fig. 4.

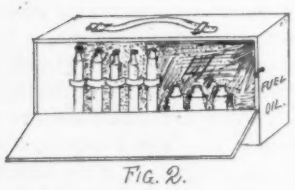


Fig. 2.

Fig. 3

Some Schemes Introduced for Advertising Oil Fuel Sale.

Fig. 5.

Fig. 6.

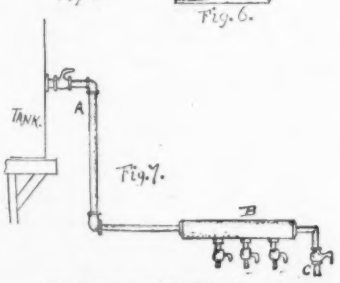


Fig. 7.

Devices Introduced for Purposes of Distribution and Use of Oil Fuel.

world over are reaping rich returns because of the oil boom for cook stove purposes, as supply tanks for fuel oil connected with cook stoves are being introduced extensively. It does not interfere with the using of coal or wood to have a tank fitted up, and, therefore, the tank is adjusted and connections made, so that in the event of another coal famine it will be necessary merely to have the tank filled with oil and the oil can be run to the stove when wanted. The tank is usually metal lined, and the exterior covered with stained woods. It sets on a bracket up out ot the way in a corner near ceiling, or may be outside and pipe connections made through the walls. From the tank, which is set above the level of the oil fuel consuming device, extends the receiving pipe *A*, with check valve, leading to the oil distributing tube *B*. From this tube are dropped two, four or more joints with check valves as shown. To each one of these pipes is fixed the necessary connections to convey the oil to any desired point. The end pipe *C* extends out and drops down to the oil fuel supply pipe of the oil fuel burning stove in the kitchen. The device is thus held in readiness, and when coal jumps to excessive values, or the coal supply gives out, the grocer or other dealer in oil is simply called upon to fill the tank and the pipes are opened, the jets in the oil fuel device lighted, and coal is not needed. All these alterations, improvements and valuable ideas along the line of oil fuel burning have been brought out during and since the coal famine of the United States, a famine which cost the people some money, but resulted in advancing the improved oil fuel burning interests very decidedly, all of which will result in benefits to the people.

The Valuation of Gas Coals.[1]

Discussion at the Institution of Mining Engineers.

In our issue of 4th October last we published and commented upon a paper on "The Analytical Valuation of Gas Coals," read before the North of England Institute of Mining and Mechanical Engineers, by Mr. G. P. Lishman. On the strength of the interest in the subject which the comments indicated the editor of the *Gas World* was invited to read a paper on the subject at a meeting of the Institute. The invitation was accepted, the paper was read in due course, and a reprint of it, together with the discussion upon it, has been issued as an excerpt from the Transactions of the Institute. The paper and the chief portions of the discussion upon it we now reproduce, by permission of the Institute, in the belief that, although originally prepared for a different constituency, they may have some interest for our readers also.

The Author said: The valuation of coal for gas making purposes is peculiar in that no ordinary laboratory method of analysis, such as serves to value most technical materials, will suffice. It is not like lime, for instance, the value of which, either for gas purification or as a cement, can be inferred from its chemical analysis; nor like a lubricant, the utility of which cau be estimated from its behavior when exposed to certain physical and chemical tests. An ultimate analysis, revealing the elementary constituents of the coal, may perhaps show its fitness or otherwise for gas making, but it is no trustworthy guide as to its value for that purpose. And a proximate analysis, showing the respective amounts of volatile and fixed products when the coal is subjected to destructive distillation, is of little, if any, greater utility. The actual value of a gas coal can only be ascertained by imitating the treatment which the coal will receive in the gas works, and thus producing from it the gas and by-products for which it is valued.

The scale on which the process is carried out may vary considerably, according to the resources at command and the preferences of the operator. The minimum, however, is fixed, in that at least sufficient gas must be produced to enable its illuminating power to be determined by the Bunsen photometer; which means that not less than 1 pound of coal, yielding, say, 5 cubic feet of gas, must be carbonized. Ordinarily the laboratory apparatus is of little more than twice this minimum, and carbonizes at one operation 2½ pounds of coal, which is practically 0.001 ton. The experimental plant of a modern gas works is generally on a much larger scale, being arranged to carbonize 1, 2, 3 or 4 cwts. of coal at once; and in a few cases it is on a scale of still greater magnitude, constituting, in fact, a small gas works in itself.

Laboratory versus Works' Tests.—In skilled hands, the small laboratory apparatus above mentioned is able to furnish very trustworthy results; but it has the drawback of almost invariably attributing to the coal a higher value than is borne out on the working scale. And paradoxical as it may seem, this failing is likely to be the more accentuated in the hands of the less experienced operator. The reason for this will be seen on a brief review of some of the particulars wherein the laboratory apparatus necessarily differs from the actual plant employed in the gas works—(1) The retort is of iron, which is a better conductor of heat than clay, and it can always be ascertained to be perfectly sound before making a test; whereas the clay retort in the gas works is of a porous nature, and has to be made tight by rendering with cement or by filling up its pores with deposited carbon, and is therefore more liable to spring accidental leaks. Then (2) the temperature is under complete control, and, if not high enough, a test can be delayed until the proper heat is attained; or experiments may be made to find out the most suitable temperature for obtaining the best results from the coal. Again (3) the coal will usually be perfectly dry before it is introduced into the retort, and that introduction will be affected with such celerity that no gas is lost in the operation; whereas, in practical working, there is necessarily a considerable loss of gas ere the lid of the retort can be closed and sealed. And (4) there is some slight further advantage in the fact that the gas is measured at a pressure little if at all above the pressure of the atmosphere; whereas, in the gas works, there is an additional pres-

1, *Gas World.*

sure, generally of 6 or 7 inches of water, due to the weight of the gas-holder.

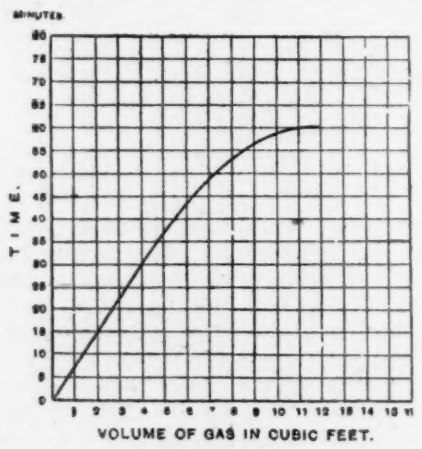
Fair Tests Bad: Coddled Tests Worse.—But there is another particular in which the laboratory method differs from the working scale operation that, perhaps more than all those above enumerated, allows of unduly favorable results being obtained, and that is the different treatment in the matter of condensing, washing and scrubbing which the gas receives. With the very best intention to obtain trustworthy results, it is impossible to subject the gas to the same rigorous treatment in the laboratory as it receives in the gas works. Owing to the smallness of the scale on which the operation is conducted, the gas cannot be washed and scrubbed with ammoniacal liquor and clean water, as is done in the gas works, without using a proportionately much greater quantity of the liquids, and so overdoing the cleansing—to the great detriment of the gas. Therefore it is usual to dispense with the washing process, and the experimenter is content with cooling the gas to a sufficient degree before purifying. Unfortunately, mere cooling, except when carried to an extreme, does not suffice to rid the gas of the minute vesicles of tarry hydrocarbons (which are carried along with the stream in an exceedingly minute state of division, and require prolonged contact with wetted surfaces, combined with some stagnation of flow, to enable them to coalesce into drops of liquid, and so allow of their removal from the gas). If every trace of these condensible hydrocarbons be not removed before the gas is tested for its illuminating power, its quality will appear unduly exalted. For the illuminating power of coal gas is due to its containing from 4 to 6 or 7 per cent. of heavy hydrocarbons, which in their composition and nature greatly resemble much of the liquid constituents of the tar; but differ from the latter in the important property of being, under ordinary conditions, incondensible from the gas. A very slight increase in the percentage of hydrocarbons, which may be caused by inefficient condensation, is therefore calculated to make a considerable difference in the result on the photometer. And if such a result may obtain with every desire to be fair, what may not be done when the gas is purposely coddled with a view to high results?

Sufficient has been said to show how a much higher value can be attributed to the coal than it may really have for the practical gas maker. By how much the estimate should exceed the reality has never been determined, though many opinions have been hazarded. It is, in fact, incapable of solution. However carefully and conscientiously the test may have been carried out, it is hopeless to attempt to predicate from the result the corresponding result that will be obtained in the gas works. It must obviously depend upon the skill and intelligence brought to bear upon the working, as well as on the degree of perfection of the plant employed. While, therefore, it will be the aim of the analyst to arrive at the ultimate value of the coal, he must ever keep in view the actual conditions of gas making, and not take advantage of his favoring circumstances to obtain results which cannot, even with the exercise of great care and skill, be realized in practice.

The Effect of the Photometrical Test.—There is one other matter that requires to be taken into consideration in interpreting the results of a coal test, and that is the question of the burner with which the illuminating power of the gas is determined, including the manner in which it is used. Obviously the burner used should be the standard one for the particular quality of gas, that is to say, the London Argand for qualities up to 18-candle power, and the batswing for qualities of 19-candle power and upwards. But it is neither necessary nor desirable that it should always be used under standard conditions. Under the absurd regulations which, everywhere but in London, govern the testing of coal gas, the illuminating power has to be determined with a fixed consumption of exactly 5 cubic feet per hour. When burning different qualities of gas in the Argand burner, a uniform consumption must be prejudicial to the lower qualities; because more air is drawn upon the flame than is required, thus cooling and over-oxidizing it, with the result of depreciating the illuminating power. The analyst should, therefore, vary the consumption to suit the quality of the gas, and calculate the result to the 5 cubic feet rate. But if this be done, it is very important that the fact should be stated in the report, so that the gas manager may know that he has to expect a less satisfactory result when the gas is consumed at the standard rate.

Mr. W. Doig Gibb's Views.—Mr. W. Doig Gibb, Engineer to the Newcastle and Gateshead Gas Company, wrote that the teaching of the paper was that what was known as a "laboratory test" would not give results comparable to those which could be obtained in actual working. This had been known for a long time. The paper was, however, of value in that it marshalled the arguments for and against the "laboratory test" in a terse and lucid manner. In larger gas works, where the capital expenditure required could be afforded, there was no doubt that an experimental plant on a working scale was of much greater advantage to gas engineers generally than a laboratory plant could be, but even then it was still a benefit to have a laboratory plant in addition, since, with the latter, tests could be taken quickly and without great cost; and though the results might not be comparable to the actual working results, they were trustworthy (if proper care were taken in testing) in comparing the different results got from the various coals tested. The author did not seem to believe in the future possibility of the tests on a laboratory plant being made in such a manner as would approximate the results got on a working scale. It might not be possible, but at all events it would be a step in the right direction if standard laboratory apparatus and standard methods of using the same were adopted. This would at all events result in the different published analyses of coal being comparable with each other. At present, owing to the different methods employed in sampling and testing, and also owing to the absence of any information on the printed analyses sheets as to the methods, etc., employed, an interested reader had great difficulty in comparing, in any accurate way, the value of one coal with another.

Mr. Lishman's Reply.—Mr. G. P. Lishman, replying to our comments of October 4th last, and on the subsequent paper and discussion, said he had been taken to task in the *Gas World* on the two statements that "there is an almost total absence in scientific journals of papers on the testing of gas coal" and that "although coal testing plants are attached to most gas works now, they are usually of but limited use to the engineer, who still has to rely mainly on his working scale results." He (Mr. Lishman) did not wish to appear contentious on minor points such as these, more especially as the *Gas World* agreed with him on the main issues of his paper; but considering the enormous number of papers published on all gas matters in these days, the three or four papers on laboratory testing of gas coal which had been published in the last 10 years could hardly be regarded as numerous. Perhaps the best of them was that by Mr. Thomas Glover, read before the Midland Association of Gas Managers in 1896; but the scale was much larger than that referred to in his (Mr. Lishman's) paper. Regarding the second statement, he (Mr. Lishman) had evidently credited more gas works with coal testing plants than actually possessed them, but this was not the *Gas World's* point. The idea that coal testing plants were of limited use to gas engineers was a general impression from his (Mr. Lishman's) knowledge of the industry. Since Mr. W. Doig Gibb was evidently in agreement with him on this point, he saw no immediate reason to alter his opinion on the subject. An interesting point had been raised, that the sperm value of a coal was not always the measure of its value to the gas maker; for with two coals of equal sperm value one might take longer to carbonize than the other and therefore be more costly. This was so, and the difference between two such coals could not be indicated by any figure in the analysis. Eight or nine years ago, the writer made observations of the volume of gas given off every 5 minutes during a test, and diagrams (see Fig.) were prepared



Progress of Carbonization.

which indicated the progress of the carbonization. As the diagrams obtained from the coals then tested were mostly very similar, the practice was discontinued. Coals from different parts of the country, however, were known to vary greatly in this respect, and he (Mr. Lishman) thought that such a diagram might, with advantage, be appended to the analysis of a gas coal. In comparing diagrams made at different times, it should be borne in mind that differences of retort tempera-

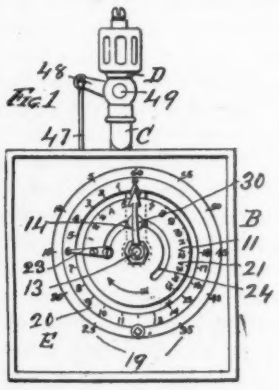
ture might have somewhat altered the general direction of the line, but this need not confuse the experienced diagram reader.

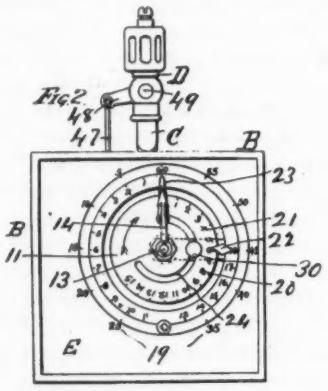
It would be an advantage to many chemists, besides those actually engaged in making tests on gas coals, if a single standard gas coal for the whole country could be adopted. Perhaps this was too much to hope for at present, but the interests involved were considerable, and many might be found to support such a scheme.

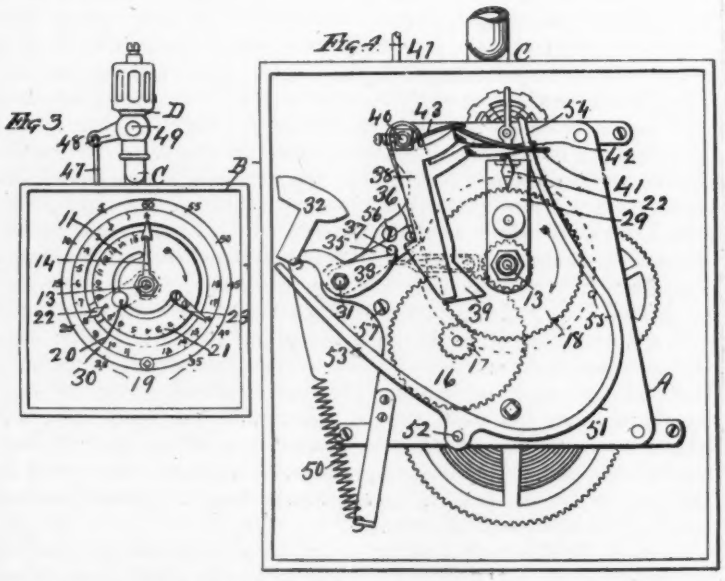
Newman's Time Light Controller.

On June 16, 1903, U. S. Letters Patent (No. 731,208) were granted to Mr. Edward Newman, of Chicago, for an improved automatic light controller, referring particularly to those lighting devices which depend on automatic control for full service and the diminution thereof. Using the words of the specification:

In the accompanying drawings, Fig. 1 is an elevation with the graduated face-plate in place, the burner valve being in its wide open position. Fig. 2 is a similar view showing the indicating devices in a different position and the burner valve in its opposite position, the light being turned down. Fig. 3 is a similar view with the indicators set in another position, the valve being in the same position as in Fig. 2 Fig. 4 is an elevation with the face-plate removed, the position of the



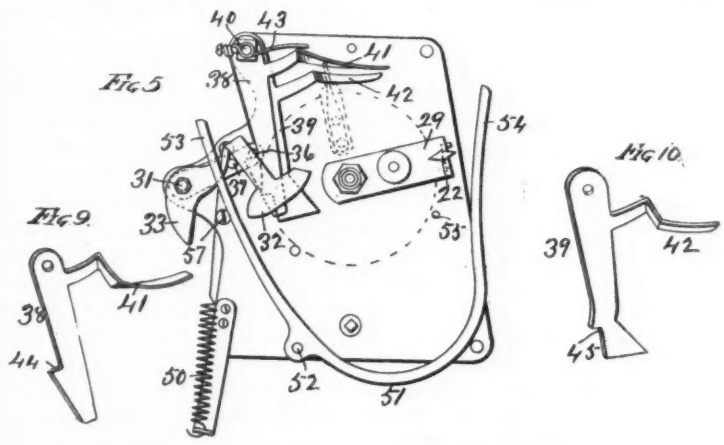


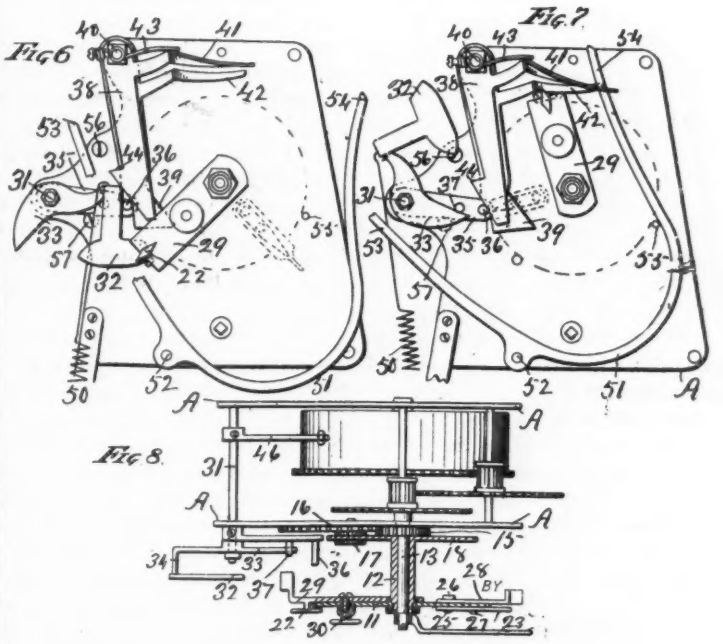


parts shown corresponding to Fig. 1. Fig. 5 is an elevation showing the working parts in a different position from that illustrated in Fig. 4. Fig. 6 is an elevation showing the parts in another position corresponding to that of Fig. 3. Fig. 7 is an elevation showing the parts in position just before the position in Fig. 1. Fig. 8 is a horizontal plan section, and Figs. 9 and 10 are views in perspective of tripping arms. Clockwork mechanism of the ordinary construction is employed as the actuating means, and a description thereof in detail will be omitted.

A represents the frame parts supporting the clockwork mechanism; *B*, an inclosing case; *C*, a pipe connecting with the source of the gas supply; *D*, a burner-tube mounted on the end thereof, and *E* a face-plate.

A revoluble graduated disk, 11, is rigidly mounted on the outer end of a sleeve or hollow shaft, 12, which is in turn loosely mounted on the clock arbor, 13, forming a bearing therefor. A minute hand, 14, is





rigidly mounted on arbor, 13, which revolves once every hour. The disk, 11, revolves at a reduced speed, and motion is transmitted thereto by a train of gears comprising a pinion, 15, rigidly mounted on the arbor, 13, a gear wheel, 16, engaged by said pinion, a pinion, 17, formed rigidly on the hub of gear 16, and a gear wheel, 18, mounted on the back end of sleeve 12 and engaging the pinion 17. These gears are so timed as to cause the revoluble disk 11 to make a complete revolution every 24 hours. The outside circle of numerals, 19, indicates minutes in setting the mechanism for fractions of an hour. The middle circle, 20, is used to indicate the number of hours that are to elapse before the light is turned up, and also the number of hours in which it will be turned down and the inside circle, 21, on the surface of the revoluble disk to indicate the number of hours the light is to burn when turned up. To illustrate, reference is had to Fig. 3, in which the double pointer 22 is set on numeral "8" in both the middle and inner circle, the stationary indicator, 23, pointing to "16" in the middle circle of numerals and the minute hand at "60." This position indicates that the light will be turned up in 8 hours, will burn for 8 hours, and be turned down for 16 hours. This combination may be changed to any time practical working may require. The revoluble disk is positioned in an opening in the face-plate and is provided with a circular slot, 24. The stationary indicator, 23, is secured to the other side of the disk in a fixed position by a small bolt, 25, having a nut, 26, Fig. 8, engaging the inner end and a fastening screw, 27, also inserted through the indicator and disk. A hand, 28, is rigidly secured to the inside of the disk in line with indicator, 23, by the same fastening devices. The outer end of hand, 28, projects beyond the edge of the disk in position to contact an object that may be located in its path. A manually adjustable hand, 29, is loosely mounted on sleeve, 12, and also has its outer end projecting past the edge of disk 11. This hand is attached to the disk by a clamping thumbscrew 30, inserted through the circular slot 24, in the disk, and which provides for the setting of hand 29 at any point within the range of the slot and in accordance with the number of hours the light is to be turned up.

A rock shaft 31 (best shown in Fig. 8) is journaled in the clock frame.

An angular movement pawl, consisting of a head end 32, a foot end 33, and a connecting cross bar 34, forming an integral structure, is loosely mounted on rock shaft 31, which extends through a foot part of the pawl, as shown in Figs. 5, 6, 7 and 8. One end of a bar, 35, is rigidly mounted on shaft 31, the disengaged end extending inward, and has two pins, 36 and 37, fixed therein. The pin 36 will be termed a "lock" or "locking" pin and pin 37 a "stop pin" in order to avoid confusion.

The upper ends of companion trip arms 38 and 39 are loosely mounted on a fixed shaft 40, and are supported in a swinging position therefrom and held normally in position to engage the pin 37 in controlling the movement of the angular pawl. A detail of these arms is shown in Figs. 9 and 10. In their relative working position arm 39 is placed back of arm 38 with an intervening space, as each arm has an independent movement from that of the other. The arm, 38, is provided with a finger projection, 41, and arm, 39, with a finger projection, 42, both of which project across and above the revoluble disk and in line therewith, so as to be in the path of the bands attached thereto and be intermittently contacted thereby at the proper time in each revolution of the disk. Arm 38 is held in its normal position by a spring, 43, and arm 39 by force of gravity. Arm 38 is provided with an uppercut shoulder, 44, for the periodical engagement of the locking pin, 36, and prevents the bar 35 from dropping to its lower position before the proper time. The companion arm 39 is provided with an undercut shoulder, 45, with which the same locking pin engages and temporarily locks bar 35 in its lower position until automatically released by the controlling mechanism.

One end of the rocker arm, 46, is rigidly mounted on the rear part of shaft 31, as shown in Fig. 8. The lower end of a rod, 47, is connected to the disengaged end of the rocker arm and the upper end connected to a valve handle, 48, mounted on the stem end of a valve, 49, located in the gas supply pipe. The angular movement pawl has four positions—an upper, lower and two intermediate ones. In the upper position (illustrated in Fig. 4) the valve handle is up, Fig. 1, the valve open, and the light turned on full head. On the down movement the intermediate position of the pawl is shown in Fig. 5, at which point it comes to full stop. In Fig. 6 the pawl has reached its lowest position, and in Fig. 7 it is shown in its intermediate position on the up movement, which is a different position from that of the intermediate position on the down movement. The pawl is retained at its highest point by means of a spring, 50, which is properly connected in its working position and readily yields to permit the pawl to move to its other positions. A U-shaped lever, 51, has a tilting movement on its pivot 52. The branch, 53, of this lever extends up on the outside of the movement pawl and in position to bear against the same at the proper time. The branch, 54, runs up the opposite side of the working parts, and when the light is turned up it assumes its innermost position, Fig. 4, in the path of hand 29. A pin, 55, limits the inner movement of the lever on that side.

The operation and movement of the different parts are as follows: The positions of the working parts in Figs. 1 and 4 correspond, the light being turned up and the movement pawl in its highest position. In this position the foot end of the pawl is in contact with stop pin 37, fixed in bar 35, which also rests at its highest point. The locking pin, 36, is now in engagement with shoulder, 44, on arm 38 and holds bar 35 in its highest position. Now, assuming that the light is to be turned down, it will be noted that hand 29 is moving in contact with branch 54 of lever 51, and forcing it back brings the branch 53 in contact with the movement pawl and throws the same down to the position illustrated in Fig. 5. The down movement of the pawl is arrested at this point by the crossbar 34 coming in contact with stop pin 37. It will be noted that the bar, 35, still remains at its highest point and the light turned up. The parts remain in this position until hand 28 comes in contact with the under side of finger projection 41, and raises it high enough to retract trip arm 38 and release the locking pin 36, when the movement pawl will be pulled down to its lowest position, Fig. 6, by its spring and at the same time carry bar 35 with it and turn shaft 31 far enough to pull the valve handle down to the turned-off position. (Shown in Figs. 2 and 3.) In this position the light will remain turned down for the time set, and at the proper time hand 29 will come in contact with the head end of the movement pawl, Fig. 6, and push it up far enough to throw the tension of spring 50 on the other side of the axial center of the pawl and complete the movement of the same to the up intermediate position. (Shown in Fig. 7.) The up movement of the pawl is arrested at this point by the foot end, 33, coming in contact with stop pin 37, the bar, 35, remaining in its lowest position and not moving with the pawl at this time, the light being still turned down. In this down position of bar 35 the locking pin, 36, is in engagement with shoulder, 45, and prevents the up movement of the bar with the pawl at this time. As hand 29 continues its movement it next contacts the under side of finger projection, 42, and slightly raising the same draws the trip arm, 39, away from its engagement with the locking pin, 36, and releases bar 35, which is then carried up to its highest position by the spring movement of the pawl and by reason of the foot end being in engagement with pin 37. This up movement of the bar 35 rocks the shaft 31 in the opposite direction from that of the down movement and turns on the light full head through the medium of the connections with the valve. The stop pins 56 and 57 limit the movement of the pawl and bar 35 to the space between.

The Teaching of Physics to Engineering Students.

[A paper read by MR. W. S. FRANKLIN at the Niagara Falls Meeting, Am. Inst. Elec. Engineers.]

I have been teaching physics to college and university students for 19 years and I now have a few ideas on the subject which can, I think, be expressed independently of the subject matter and which may be helpful to others.

Some time ago, in talking with a practical engineer on the teaching of physics, I stated that in my opinion the ultimate object of the teaching of physics to technical students is to lead the young man by a shortened route to that familiarity with physical things which is possessed by such a man as John Fritz. The shortening of the route which leads to this result depends upon the fact that the teacher of physics has to do largely with an epitome of real knowledge, and consequently the primary object of physics teaching is, in my opinion, to develop in the young man's mind a logical structure consisting of the aggregate of physical conceptions and theories.

Since beginning the teaching of physics, I have never devoted any of the time of my classes to the discussion of the history of the subject. The best way to study an organic structure is to study its history, through the medium, say, of embryology, but this is the worst possible way to study a logical structure.

I have never on any occasion apostrophized the wonders of nature to any class of mine. The ability to measure electricity and the ability to calculate magnetism are really very simple and prosaic things, and any writer or teacher who for a moment allows himself to speak of these things otherwise than in explanation or in application, may be set down at once as attempting to lend an element of mystery to knowledge he claims to possess. It seems to me a very significant fact that in most of the cases that have come to my notice the appeal on the part of a scientific writer to the reader's wonder sentiment has been associated with very hazy or entirely faulty notions on the writer's part. I know of a text-book on physics which introduces the discussion of the doctrine of the dissipation of energy in the chapters on mechanics; this text-book actually would have it appear that the degradation of energy is essentially the change from the potential to the kinetic form, and the whole discussion ends as follows: "Tait calls available energy entropy. The inevitable conclusion is that entropy tends toward a value of zero. In the beginning, then, points to a period when all energy was available. With no less certainty, physical science points to a time when entropy shall become zero. All the processes of nature must then cease. Even the earth itself, as lifeless as the moon, can no longer circle round the glowing sun, but both and all together, in one dead mass, must hang in everlasting silence in the boundless night of space." Now, what I want you to keep in mind, is that this wonderful view down the corridors of Time is ostensibly based, in the book in question, upon a succession of egregious blunders.

I have never allowed the slightest speculative tendency to enter into my teaching, oral or written, and the extent to which many of our elementary text-books in physics indulge in imaginative nonsense and in weak phases of speculative philosophy is distressing to me. Nearly every text-book on physics that I know of defines the mass of a body as "the quantity of matter the body contains." I had the pleasure 13 years ago of listening to a course of lectures by von Helmholtz on theoretical physics, and the first 8 weeks or more of this course was devoted to the origin and meaning of our quantitative methods in physics. I thought at the time that von Helmholtz's statements were so simple and so apparently remote from the usual complications of physics that most of his hearers were likely not to appreciate what he said. Those lectures, however, stand in my mind as the most complete outline of the philosophy of the mathematical sciences ever given. All our notions of length and angle arise from and are defined by the fundamental geometric operation of congruence. The definition of mass is also a physical operation; the verbal definition is the briefest possible

specification of this operation. The result of this operation on a given body is an invariant number, and by a feat of the imagination we are led to adopt this number as a measure of the "amount of matter the body contains." This is a notion of some mental utility, although strictly it is mere imaginative nonsense. Several years ago I had occasion to review a well-known French book on "Electrical Measurements," the authors of which say "Une grandeur est une quantité susceptible d'augmentation ou de diminution. Une grandeur est dite measurable quand on peut la comparer à une grandeur de meme espece et que la résultat de la comparison donne à notre esprit une satisfaction complète."

As an example of weak speculation, what do you think of the use in a secondary school book on physics of the following quotation from Maxwell as a means to clear up an inadequate discussion of energy? "We are acquainted with matter only as that which may have energy imparted to it from other matter, and which may in its turn communicate its energy to other matter. Energy, on the other hand, we know only as that which in all natural phenomena is continually passing from one portion of matter to another." What do you think of the following from an elementary English text-book on physics? "The fundamental property of matter, which distinguishes it from the only other real thing in the universe, is inertia. * * * We are now in a position to give one or two provisional definitions of matter—provisional because we cannot yet say, possibly may never be able to say, what matter really is. It may be defined in terms of any of its distinctive characteristics. We may say that matter is that which possesses inertia, or again since we have no knowledge of energy except in association with matter, we may assert that matter is the vehicle of energy." I wonder if any of you really doubts that every notion in physics, definite or indefinite, is associated with and derived from a physical operation, and that absolutely the only way to teach physics to young men is to direct attention to that marvellous series of determining operations which bring to light those one-to-one correspondences which constitute the abstract facts of physical science. If you do doubt this, I am bound to say that I do not think much of your knowledge of physics. I think that the sickliest notion of physics, even if a student gets it, is that it is the science of masses, molecules and the ether. And I think that the healthiest notion, even if a student does not wholly get it, is that physics is the science of the ways of taking hold of bodies and pushing them.

In my opinion, the characteristic feature of science study, especially of the study of physical science, is a determining objective constraint upon the processes of the mind. I am surprised that this one important feature of science study is never mentioned in the many estimates that have been made of the value of science study in education, for as a matter of fact, that complete definiteness which is usually urged as the characteristic and valuable feature of science study in the fundamental condition of every psychological process; you say this or you say that, you go or you do not go, and even the classic mule, standing midway between two similar loads of hay, is in no danger of starving from indetermination. The psychological processes which are brought into play in the study of science do not differ from other psychological processes in regard to definiteness.

I say again that it is the completeness of objective constraint that chiefly differentiates the study of the physical sciences from all other studies and which makes the study of the physical sciences so important an element in any correct scheme of education. The importance of this objective constraint upon the mental processes in scientific work is most strikingly shown by the entire absence of any such constraint in all of our crank scientific literature. I think that the full realization of this objective constraint in the teaching of physics depends first of all upon the making of one's teaching utterly and absolutely simple and homely, and devoid of all appeal to anything but the rigors of the scientific imagination. Anything beyond this is, in my opinion, idolatry.

I think that the ability to learn science by reading is a highly specialized faculty, and that among average young men this faculty is nearly zero.

I know many young men who are quick to receive knowledge by experience, and quick to catch, from verbal description, manifold variations of their empirical knowledge, but whose imagination is wholly unresponsive to that abstract kind of writing which is so necessary in a concise treatise on the elements of physics.

Nevertheless, I think that the development of the student's imagination, to the extent that it is necessary for him to follow concise writing, is one of the chief objects in the teaching of physics, and I do not believe that this result can be accomplished without requiring the student to use a text-book of the severest kind.

My idea of the teaching of physics is to use a sharply, clearly and concisely written text-book, to give explanatory lectures of such character as to appeal properly to the student's imagination (theoretical lectures, in fact, illustrated by the simplest kind of experiments), to require of the student a large amount of numerical calculation, and to give a laboratory course based upon highly generalized printed directions supplemented by a vanishing series of verbal suggestions from an instructor.

I think that the chief object in a course in physics for technical students should be to give conceptional and analytical knowledge of the most important facts of physics. It is certainly better to know a little by reason than much by rote. There is nothing in the teaching of physics so important as to develop in the student the ability to express physical conditions in mathematical form, geometrical or algebraic as the case may be, to reproduce or re-present the conditions of a problem adequately as a geometrical construction or as an algebraic formula. Nothing, I think, is so important as this for technical students. It is the very essence of effective knowledge of physics, and every bit of attempted instruction in physics which does not contribute directly or indirectly to facility in this re-presentation of physical fact in terms of our mental tools is in my opinion futile.

Many students and even teachers of physics raise the objection that a rigorous mathematical presentation of physics is highly unsatisfactory and uninstructive. They like such a book as the excellent new book of Edser's on "Light," which abounds in descriptions of phenomena, and of the most recent researches on light pressure and the cause of comets' tails Now, I am really interested myself in comet's tails, but I would feel like thrashing a young student who concerned himself about comets' tails and held his imagination unresponsive to a discussion of stationary wave trains and of reflection with and without change of phase. I have a contempt for a student who thinks he understands the formation of a comet's tail, but admits that such things as the kinematics of wave motion are beyond him. I recommend such a student to be honest with himself, and study physics under the instruction of Jules Verne. Then he need not trouble himself about foundations, but he may follow his teacher pleasantly on a careless trip to the moon, and with easy improvidence embark on a voyage of 10,000 leagues under the sea.

In my teaching of physics I have come to distinguish two distinct phases of laboratory work. One phase is that which is intended primarily to vivify algebraic formulæ—I think it is silly to talk of the verification of nature's laws (!) by a student—and the other phase of laboratory work consists of elaborate and precise measurements carried out with every possible precaution for the elimination of error.

The Mechanical Cause of Gravity.

By Robert Stevenson, C.E., in *Elec. World.*

In an article on May 26, an experimental method of producing orbital motion without the mutual attraction of matter was given. On June 2 a letter appeared from Mr. T. Wolcott saying that he had tried the experiment by means of a water nozzle held in his hands, and although the apparent motion of the water was helicoidal, yet he believed the actual motion was not so; and gave his reasons. On June 9, in reply to Mr. Wolcott, I explained that his experiment was entirely different from the one given by me, because he held the straight nozzle in a radial position, whereas in my experiment the water and balls were projected tangentially to the circle of rotation. Furthermore, the water in his case could not have a velocity of 100 feet per second, because he could not rotate a nozzle by hand with water jetting through it at that velocity. And it should be constantly remembered that the stability produced by the momentum of the mass is the proximate cause of the novel effect.

I satisfied myself years ago that the effect could not be got from garden nozzles in the way he tried. But curious to say when I ask scientists to test this experiment, they invariably do as Mr. Wolcott did, and then make up their minds that the apparent effect is an optical illusion. I further mentioned in the letter of June 9 that I was prepared to prove that Galileo and Newton in formulating the first principles and laws of motion had neglected to recognize the all-important fact that lineal momentum produced kinetic stability, and that stability supplied the force which Newton called centripetal force, and which he ascribed to the mutual attraction of matter; that component force is the cause of the helicoidal motion of balls or planets; that force changes the direction without doing work. That is, the force which Sir Oliver

Lodge has been trying to make out to be a mental force. And he is really nearer the truth than he imagines, because kinetic stability is produced by the combined effort of power and intelligence. But as we are only dealing with the physical effect here, it is unnecessary to trace the psychological interaction.

In proof of the statements made in the letter of June 9, I had a series of articles ready to be published, but as they dealt with first principles it has been thought that they would not interest technical readers so much as the practical application of them would do. Consequently, I propose to print them in pamphlet form, and will be pleased to send them gratis to any readers who will forward their address to the editors. In the meantime, I will devote this article to one phase of the practical application of the principles, so as to show by a kinetic illustration how motion can produce weight and energy without attraction.

Let us suppose a car A, 25 feet long and 10 feet wide and 10 feet high, with mass M (but no weight), moving through free space in a straight line in accordance with Newton's first law of motion. (See Nat. Phil. § 244.) Inside of car A let there be another car B, 3 feet long, 2 feet wide and 2 feet high, whose mass is m, also having no weight. Let $M = n\ m$, where n is a very large number. At the front end of car A let a power hoist be fixed with a rope the full length of the car. At the rear end of car A let car B be at rest against the end partition, on a pair of rails which run all the length of car A. Then fix the rope to car B, and hoist it up towards the front end of car A with velocity v. A momentary impulse will supply all the force necessary to give it the uniform velocity v, and momentum, $m\ v$. The amount of that impulse would be $m\ v/t = m\ a$. Now suppose we return car B to the rear again, and car A be given a uniform acceleration of 32 feet per second. Now so long as this constant acceleration continues in the motion of car A, we can feel that car B is being pressed against the rear end of car A with the pressure $M\ g$, where $g = 32$.

Now that pressure is weight, exactly the same in quantity and quality as if B was on the surface of the earth. Now suppose a committee of philosophers were selected to investigate this pressure of B against the rear end of the car, and suppose there were no landmarks by which they could discover that A had acceleration. They having been born and brought up in the car. Let us call them Epicurus, Aristotle, Galileo, Newton, Boyle. Epicurus attempts to explain the cause of the pressure: First, he tugs at car B, and when he lets go it constantly falls back towards the partitions. After much experimenting and thinking, he gives his opinion that car B has a desire to rest against the partition, and that it takes a big effort to prevent it.

Aristotle said, yes, there is an apparent desire, but the desire is due to everybody in the universe having a right place to which it belongs naturally, and it can only be prevented by an effort from getting there, and when once there it takes an effort to remove it, and when the effort stops it tends to go back to its right place. And, furthermore, he said that desire to get to its place increases with its density, and also with the shape of the body. That desire is its gravity.

For 2,000 years that explanation of Aristotle was the orthodox doctrine of gravity, until Robert Boyle put the car B in a vacuum and kept reducing its density and found that it fell just as fast back to the partition when its substance was as light as down, as when it was gold; and that fact upset Aristotle's theory of gravity. But whilst Boyle was experimenting with his vacuum, Galileo was experimenting with the rate of fall. His idea was more scientific than philosophic. He wanted to find the law of the fall. He did not believe that the fall was due to desire; but whatever the cause might be was of very little consequence compared to the law of the fall; because the fall could not be utilized with certainty until the correct law of the motion and pressure was found.

The idea never seemed to enter Galileo's mind that the little car did not fall at all, but that it was the big car that was doing all the falling.

After Galileo came Newton, who accepted Galileo's laws of the fall of bodies, and never doubted but that the fall was genuine; and he also said that although it would be nice from a philosophic point of view to know why this car always tended to that partition, yet the law was of the greatest importance for mankind to know. He did not agree with Epicurus that it was by desire, but he thought a more appropriate term to use would be attraction. Then he demonstrated geometrically that the partition attracted the little car and the little car attracted the partition directly as the mass of the one multiplied into the mass of the other and inversely as the square of the distance between them, the formula being $g\frac{M\ m}{d^2}$ where g is the constant of gravitation, or as we have seen, the rate of acceleration of A. It might be asked what has M and m and d to do in the formula when the fall of the body depends entirely on g? But it must be remembered that although the rate of fall may be independent of the mass of a body, yet the force depends on the mass, $F = m\ g$; and although it is not m that is falling, yet it is the inertia of m which continually resists the constant impulse produced by the acceleration of car A, and the effect of that resistance is the pressure we call weight.

The car B, to begin with, had no weight, only mass, and now it has been converted into a weight, by a mode of motion; and that in spite of the orthodox theory, that weight could only be produced by the mutual attraction of the particles of matter in the partition and in the little car. There may be those who hope that I may be mistaken in my analysis, and that although it can be shown that weight is a mode of motion in this case, it may not apply to the case of bodies on the surface of the earth.

Now that the theory of attraction is shown to be untenable, let us investigate that most wonderful condition called energy. Energy has been adored as the greatest discovery made by science since Newton discovered the mutual attraction of matter, and with matter it is said to be the one eternal condition in the universe. Consciousness and force may come and go like a bank rate, but energy goes on forever. And there are many great philosophers and scientists who really believe that mankind can never know more of the Creator than what is shown in these two attributes of the cosmos. In the figure let A represent the large car, and B, B_1, B_2, represent the small car in different positions. Let C represent the hoist, and the arrow the direction of motion of A. Let us suppose the little car B (which we will call the body) is resting against the rear end partition of car A; and car A is being accelerated uniformly at the rate of 32 feet per second $= g$. Then car B, or body, would press against the partition with the weight, $m\ g$, exactly the same as it would do on the surface of the earth. Let a rigid but weightless rope connected with the hoist have a spring balance next the hook, which attaches it to the car B, or body; and when the hoist relieves the partition of the pressure of B, the spring will indicate the pressure, $m\ g$, the same as it would do if B was suspended by the balance at the earth's surface.

Now, if the hoist gives B uniform motion towards B_2 at the rate of 16 feet per second, $= v$, the power required would be $m\ g\ v = P$. And in time t, the work done would be $m\ g\ v\ t = P\ t = f\ s$, where $s = 16$ feet. But when the power stops working at distance S, the body B will not stop at once, but by reason of the impetus, $m\ v$, will be carried a further distance, $h\ v = {}^2/2g$; at which height the body appears to come to rest relative to car A, but not relative to the fixed co-ordinates in space. When dealing with two sets of co-ordinates, great care must be taken in specifying which set is referred to. I find that it was due to that want of care on the part of Galileo and Newton that they were deceived into the belief that appearances were realities, and whilst thinking they were superimposing momenta they were only superimposing velocities, and consequently they failed to find the true physical result. So long as the power P is moving the weight $m\ g$, with the uniform velocity v, there is a definite amount of work being done, $= m\ g\ v\ t = m\ g\ s$, where t and s are time and distance, respectively. But when the power stops, then the impetus of the body carries it a further distance, $v^2/2g$, before it appears to stop, when the kinetic energy is said to be converted into potential energy. And the whole work, $W_1 = m\ g\ (s + h) = m\ g\ s + {}^1/_2\ m\ v^2 = {}^3/_2\ m\ v^2$.

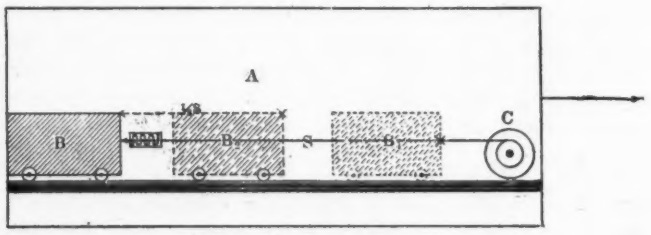
If we take a case where B is projected forward from the partition by an impulse, with an initial velocity of 32 feet per second $= v$, then in 1 second $= t$, the distance traveled by B is $v^2/2g = 16$ feet, the same distance as in the previous case that the power traveled in the same time with only half the initial velocity of this case; but in that case the velocity was uniform, whereas in this case there is a uniform retardation (apparently). Consequently, in this case the kinetic energy $= \frac{1}{2}\ m\ v^2$, the average velocity during this time being $\frac{1}{2}\ v$.

Now, when the body, B, comes to rest relative to the car A, all the kinetic energy of B is said to be converted into potential energy, and then to appearances, B begins to fall of itself towards the partition at the rear end of A, with an accelerated velocity the same as bodies falling at the earth's surface. That is the phenomenon which is presented to the inhabitants of the car, who do not know that their car is being accelerated, and never dream that the apparent fall is due to that accelerated motion, but who believe with Galileo and Newton that the body actually falls, and that there must be some attractive influence in the rear end to produce that accelerated fall.

The formulæ in both cases are the same as that of falling bodies at the earth's surface, and in the pamphlet it will be proven that weight and energy are produced in the same way in both cases. The first law

of motion will be subject only to the principle of *Kinetic stability*, which is the only *new principle* to be established to take the place of attraction.

But in this change of principles we must not forget that kinetic stability produces an effect to all appearances the same as attraction, and consequently there will be little change in the integral resultants, although our ideas will change about the cause of a stone falling, yet that change in ideas will not alter the result, Whether it be the rate of fall, or the blow struck by the body when it reaches the earth, Galileo's and Newton's laws will still hold as before, only we will know the cause of those laws, which up till now had to be taken on faith. It is unnecessary to take up space analyzing the correlated motions of the two cars, as those readers who can follow the argument can do that for themselves, and so become convinced that B does not fall back, as it appears to do towards the rear end partition of car A. Consequently the mass of the partition cannot be the attracting cause of the apparent acceleration of B towards it.



Mechanical Cause of Gravity

The facts to be noted in this illustration are:

1. That the accelerated motion of car A induces weight on car B without attraction.

2. That to move that weight forward is like lifting a weight vertically upwards at the earth's surface, and it requires the same power.

3. To project B forward with an initial velocity requires power and and work, and produces energy, the resultant being called the space integral of the force $= F\,S = 1/2\,m\,v^2$.

4. When the kinetic energy is transformed into potential energy, the true cause is the motion of A, not the attraction of its rear end, as taught at present.

5. The reversibility of the process is apparent, when we know that the velocity acquired by the car A in one second is eqnal to the initial velocity of B, when the two come to rest relative to each other in one second.

Suppose B be given an initial forward velocity, $v = 32$ feet per sec., it would continue uniformly at that speed, but owing to A having an accelerated velocity of 32 feet per second, then at the end of the first second both are moving with the same velocity in the same line and direction, and consequently are at rest relative to each other. But at the end of the next second, A has acquired a velocity equal to $2v$, whereas B is still moving with velocity u; consequently, the rear partition of A strikes B with $2v{\cdot}v = v$ velocity; but the philosophers in the car think it is B that strikes the partition in the same way as Galileo thought it was the projectile that fell to the earth.

What I intend to prove in the article which I propose to print and distribute in pamphlet form, is:

1. That Galileo, in studying the laws of falling bodies, made the mistake which many might make in supposing the little car, B, to be the falling body in the large car just shown. The appearances would be the same and the laws the same, but the causes are different. The scientist might say, "What does it matter whether the train goes to the stations or the stations come to the train; the timetable is the important knowledge." But if old George Stephenson could have made mankind believe that the stations come to the train, as Galileo and Newton have made them believe that the stone falls to the ground, then who would ever have thought of improving the locomotives. And so throughout the whole range of the arts and sciences, new inventions and improvements have followed rapidly the true knowledge of causation.

2. Galileo and Newton made a serious mistake in supposing that a cannon ball at rest in a moving car when rolled across the moving car was having the two motions or momenta compounded on the ball, whereas the motions so apparently superimposed are relative to different sets of co-ordinates and consequently it is not a case of compounded momenta at all. It is just as much an illusion as that of the falling body.

To compound momenta on a moving ball, both components must be measured relative to the same fixed co-ordinates, and for such motion there is no law at present.

3. Galileo and Newton, in laying the foundations of dynamical science, failed to notice that a mass which has inertia and acquired that inertia through certain kinds of motion to which it has been subjected, almost in a similar way to that by which an electric charge acquires inertia by self-induction, as Oliver Heaviside has so clearly shown.

4. Having failed to grasp the true cause of inertia, they also failed to discover the persistence of lineal momentum, which without doubt is the most important principle in the universe, as it applies to both physical and mental forces. This persistence of momentum increases with the momentum, and it is this principle which produces the stress on a fixed guide, or connection, when a body with its own momentum describes a curve without loss of motion, and produces the stress apparently from nothing and disappearing when the body describes the tangential straight line again. That persistence increases with the momentum, although Galileo's law of inertia indorsed by Newton denies the existence of such a principle.

5. Without a knowledge of the persistence of momentum it was impossible to grasp the hidden key to the treasures of nature. This key I have called kinetic stability. Kinetic stability is simply the tendency of displaced momenta to return to their place, as was taught by Aristotle 2,000 years ago. But, of course, it has a meaning and purpose grander and more profound than even the wise old Stagyrite could appreciate; because it explains elasticity, gravity and all the other forces of nature whose causes are still ignorabimus to science. But the explanation, proof and application of this principle in its most rudimentary form will take up 50 pages of the pamphlet, and to that I must refer the reader.

6. The parallelogram of forces when applied to free celestial motions is another fallacy, formulated and established by Galileo and Newton. But when applied to terrestrial mechanics is perfectly correct, when the components are compounded simultaneously, because then the problem is one of statics so far as the composition is concerned. The true resultant when two transverse component momenta are compounded relative to the same fixed co-ordinates, is a geodesic curve of least action, where $s\ l\ v\ d\ s$ is a minimum. For the proof see the pamphlet.

7. When a car is moving with uniform velocity, v, in a straight line in space, and a ball is at rest in the car, the ball having mass $= m$, and velocity v, the same as the car; its momentum $= m\,v$, relative to the co-ordinates by which the car's motion is measured. Now if that ball be given a velocity, v, backwards, and relative to the car, then its momentum relative to the car is $-\,m\,v$. Now Newton calls that compounding momenta in opposite directions, and he lays down the law, $m\,v - m\,v = 0$. (See Nat, Phil., § 252.) In this case we have two momenta which completely annihilate each other, masses and everything disappear, and nothing is left to show that they ever existed. However, when we more closely analyze the motions, we find there is no compounding of momenta, because the components were measured relative to different sets of co-ordinates. It is simply a case of two equal and opposite velocities equating each other, and the mass of the ball is left standing relative to the fixed co-ordinates in space. Had the ball been moving with the same speed, v, free and independent of the car, and it had been given an opposite velocity, v, without stopping its previous force, $m\,v/t = m\,a$. Then the power necessary to compound the two components would be $m\,a\,v$, which is the true law, instead of that given as $m\,v - m\,v = 0$. The proof of this rule will be given in the pamphlet.

Having dealt with the laws of motion and shown that the Newtonian laws are only correct for terrestrial and apparent motions; that the most important motions in nature, celestial and molecular, are still without laws of a kinetic character, and have hitherto been only explained by the use of the mathematical metaphor which Newton called attraction, and the belief that bodies fall to the earth, we will then show how the true laws of motion explain the phenomena of the portions of the universe within our capacity to analyze and measure, thereby replacing the Newtonian system with one better suited to modern science, and more fruitful in its results, so far as the explanation of causes is concerned.

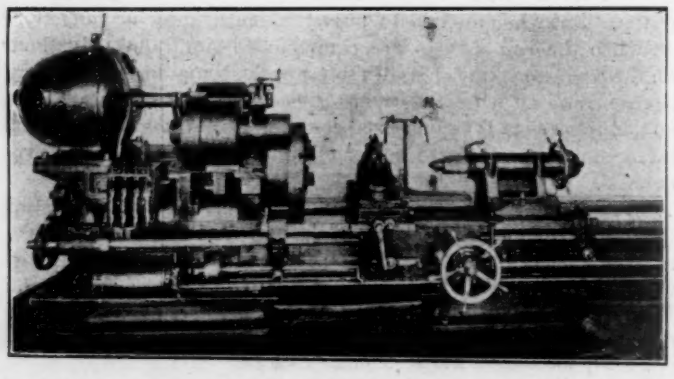
A CERTIFICATE incorporating the Citizens Gas Company, of Freeport, L. I., has been filed with the Secretary of State. Under its provisions the Company proposes to supply gas for lighting, heating and power purposes in the villages of Freeport and Rockville Center. It is capitalized in $50,000, and the Directors for the first year are: John L. Gerety, of Patchogue, L. I.; Nelson Paine, of San Francisco, Cal., and Frederick W. Owen and Ira J. Bogart, of Passaic, N. J.

A Heavy Service Lathe with Electric Drive.[1]

The view shown herewith illustrates well the new style in machine tool building due to the advances made in the past few years in shop methods. Air hardening and other special tool steels which permit of very high rates of metal removing, that is heavy cuts and feeds and great cutting speeds, require heavier lathes and planers than have been standard. The old machines are not sufficiently rigid, or massive in frame or strong enough in drive and gearing, to withstand such cuts and feeds; in consequence new machines, stronger and heavier throughout, were called for, and many builders of machine tools have met this demand by bringing out a special line of machines.

Direct driving by electric motors has also established itself as a requisite in modern shops. It decreases the cost of the power required by eliminating the greater part of the transmission losses (in shafting, etc.), and adds to the convenience of handling the tool. A large part of the belting is done away with, and crane service becomes available over the whole shop area. Both direct and alternating current have found successful application to machine tool driving, though the former is considerably in the lead. With either system large tools are advantageously driven by a motor direct connected to the driving shaft of the machine; smaller machines are often grouped, with a common drive shaft taking power from a motor. In arranging large machines for electric driving, the conversion has often been accomplished by setting the motor in the base or on a bracket attached to the machine, which otherwise was identical with a belt-driven machine. In other cases, however, the machines were specially designed for electric motor drive, without reference to the forms developed for belt-driven machines.

The machine shown herewith is of this class. The usual cone pulleys



26-Inch Lathe for Heavy Service, with Direct-Connected Motor and Multiple-Voltage Speed Control.

in the headstock are replaced by a seat for the driving motor and its gearing, and the electrical control switches. The machine is designed for the heaviest service which two tool posts can require. The lathe, of 26-inch swing, was made by the Bullard Machine Tool Company, of Bridgeport, Conn., while the driving motor and controller were supplied by the Crocker-Wheeler Company, of Ampere, N. J. The mechanical features of the machine comprise (besides the general strong and heavy construction for most rapid production) two tool posts, front and rear, which may be fed simultaneously inward or outward, a 2-speed gear change in the transmission from motor shaft to spindle, a hand travelling attachment for the tail-stock, and a lubricator pump belted from the motor shaft. The driving motor is a shunt-wound machine rated at 20-horse power. Rigidly connected with the armature shaft is a pinion shaft carrying two pinions; by shifting these in one direction or the other they engage with corresponding gears on an intermediate shaft, which drives the spindle by a spur pinion. The motor is supplied by a 4-wire system, which makes 6 different voltages available. Since each voltage has a definite motor speed corresponding to it, there are 6 speeds possible without employing resistances; a field rheostat for weakening the field circuit serves to give the intermediate speeds. The 2 speed pinion gearing again doubles this range of speeds. The changing of connections is all done automatically by a controller mounted at the front of the headstock below the leadscrew. As may be seen in our photograph, there is a third longitudinal rod in front of the machine, in addition to the leadscrew and the feed shaft. This rod gears to the spindle of the controller; it is operated by bevel gears from a vertical hand lever at the right of the apron. In this way the lathe operator has the speed control right at hand, without moving away from his work.

1. *Engineering News.*

Water Gas Manufacture by the Kramers and Aarts Process.

The following is an abstract translation from the *Journal of Gas Lighting* of a paper on "Water Gas Manufacture with Special Reference to the Process devised by Drs. Kramers and Aarts," read by Dr. Alph. Steger, of Amsterdam, at the recent meeting of the German and Swiss Associations of Gas and Water Engineers at Zurich.

Until recently water gas manufacture was virtually restricted to the United States of America and England; but now its good qualities have attracted the attention of gas men in other countries—notably in Germany and Austria. Distinction must be drawn, however, between the oil carburetted water gas of the first period and the simple or "blue" water gas now coming to the front. Changed conditions are responsible for the advent of the latter. The supersession of the flat flame by the incandescent burner for lighting purposes has rendered it no longer necessary to provide gas of high illuminating power, or even of high calorific value, provided it affords a high flame temperature. Simple water gas has a very hot zone of combustion; and hence it is taking a prominent position in the lighting world. Moreover, gas rendered illuminating by means of oil vapors is not so acceptable to technical men as a simple gas, which affords a high temperature, for welding, soldering, forging, etc. Nevertheless, carburetted water gas would probably continue to compete with simple water gas but for the advantages offered by the quite recent idea of introducing water gas into the retorts during the production of coal gas, and thereby forming a mixed gas not very dissimilar in properties to coal gas itself. The results of trials of this process have shown that it presents great advantages, and that, consequently, the manufacture of simple water gas is now of greater importance than that of carburetted water gas.

Two fundamentally different modes of producing simple water gas have to be considered—viz., the continuous and the intermittent. Steam is passed through a layer of incandescent fuel in both; but the heat required to maintain the water gas reaction [$C + H_2O = CO + H_2$], is supplied either continuously or from time to time by the cessation of the steam admission and the application of an air blast to the fire. According to Lang, the reaction $C + 2H_2O = CO_2 + 2H_2$ begins to take place at a temperature of 100° C., and only gives place entirely to the aforementioned water gas reaction about 1,000° C.

Hence it is neecesary to maintain the fuel at about the latter temperature; and clearly the continuous supply of heat to the fuel would present manifest advantages, in that the latter would be kept at a constant temperature, and the gas made would, therefore, be of uniform composition, while the wholly unavoidable losses of heat would be kept as low as possible. There are three ways in which the continuous system might be carried out in practice—viz.: (1) By external heating to restore to the fuel the heat abstracted from it through the formation of water gas. (2) By prior superheating of the steam to such an extent that its sensible heat balances the heat of decomposition. (3) By the admixture of neat oxygen with the steam.

The first of these methods entails heating the generating vessel just as coal gas retorts are heated, but maintaining a higher temperature than the 800° C. or thereabouts of the latter, and that in face of the considerable absorption of heat by the water gas reaction. Coal gas production, on the other hand, entails little or no such absorption of heat. This method could only be worth pursuing if a material were available for the retorts which was a good conductor of heat and capable of withstanding high temperatures and highly superheated steam. In the absence of such a material, the method must be considered impracticable.

The second way in which the continuous method might be carried out has often been named in patent specifications. But theoretical considerations show that, in fact, it cannot be successfully followed in practice. Assuming that the fuel in the generator is at 1,000° C., that the water gas leaves the apparatus at 500° C., the water gas reaction requires about 18,000 calories. (The method of calculating this figure has been given by Dr. Kramers in his articles on "Water Gas Manufacture in Theory and Practice.") To bring this heat to the fuel through the steam requires the latter to be heated to about 2,200 C. (taking Le Chatelier's formula $7.56 + 0.0065\ t$. for the molecular specific heat of steam under constant pressure). Apart from the dissociation of the steam and the formation of explosive gas which would occur to a considerable extent at this temperature, the practical difficulties in the way of heating steam to such a degree are manifestly insuperable. Indeed, the transference of large quantities of heat by means of steam or gases is in all cases a very difficult problem. It may be further discussed here because it has recently been proposed to apply the waste heat of fuel gas as made to produce the steam required for gas making.

Now, if the fuel gas contains (say) 18 per cent of hydrogen, about 207,000 calories will be required to make the necessary steam. The temperature of the escaping gas from the generator may be taken at about 400° C.; and from the steam producer or boiler under the most favorable conditions, at 100° C. Consequently, the hot gas (taking its specific heat at 6.8) would only give up about 204,000 calories per 100 cubic meters, or 3,000 calories less than is required to produce the steam. Practically, however, the duty would be still less, because of radiation. Moreover, even if the waste heat of the gases sufficed to produce the steam, difficulties would occur owing to the greater heat in the generator causing disintegration of the firebricks, melting down of the grate, etc. It is even worse if the attempt is made to heat up at the same time the air used in producing fuel gas, as to heat this to 100° C. would require a further 3,000 calories—making a deficiency in all of 6,000 calories. The same objections apply also if the steam and air are introduced alternately to the generator, instead of simultaneously, and the attempt is made to utilize the waste heat of the escaping water gas and producer gas to produce the steam or preheat the air supply.

Passing on to the third way in which the continuous method of water gas production can be carried out—viz., by mixing oxygen with the steam—the product will no longer be water gas proper, but a mixture of about 70 per cent. of carbonic oxide with about 30 per cent. of hydrogen. Apart from hygienic objections, the mixture would be an equally good fuel gas, and would more nearly approach the ideal gas (carbonic oxide only) for raising mantles to incandescence. This method does not present technical difficulties, and could doubtless be followed. But it would be too costly at prevailing prices for oxygen, except on a laboratory scale. The conclusion, therefore, is that the continuous method of making water gas is either impracticable or too costly.

The intermittent process for making water gas involves the actions of heating up and cooling off of the fire taking place one after the other instead of simultaneously. The temperature in the generator having been brought high enough, steam is injected, and the water gas produced is led away until the temperature has fallen so low that the production of true water gas begins to cease, whereupon the inflow of steam is interrupted and the fire is blown up afresh. The intermittent character of the process appears to entail great losses of heat; and there is no question that they are greater than when neat oxygen is used for the continuous production of a kind of water gas. But if the intermittent process is properly conducted, very little heat escapes utilization.

It will be convenient at this stage to consider the most advantageous manner of blowing up the fire. The combustion of a molecular quantity of carbon to carbonic oxide liberates 29,400 calories; while the combustion to carbonic acid liberates 97,600 calories. It is, therefore, advantageous to form as little carbonic oxide as may be; and practice teaches that (1) combustion takes place almost solely with the formation of carbonic acid at low temperatures, while the chimney gases are richer in carbonic oxide as the temperature rises; (2) the proportion of carbonic oxide at a particular temperature is dependent on the depth of the bed of fuel; and (3) the proportion of carbonic oxide is dependent on the rate of flow of the air for the same temperature and the same depth of fuel bed.

It may be deduced from these observations that carbonic acid is first formed, and is reduced at a sufficiently high temperature to carbonic oxide. This reduction must be as far as possible prevented, in order to secure a proper heating up of the fuel; and it follows from the foregoing that three means are available for this purpose—viz., (1) Maintaining the fuel at a low temperature, (2) having a high rate of flow of the air, and (3) having a shallow bed of fuel. Obviously the first means is not of service, because the water gas reaction demands a high temperature. The shallow bed of fuel undoubtedly gives an economical result from the blow; but it does not admit of the steam flow being adequately large during the gas making, because steam would pass through undecomposed. A very powerful blast is, therefore, the only means available. But even with it some carbonic oxide will be formed, because at a given temperature the speed of reduction of the carbonic acid will have become greater than any velocity of the air blast; and, naturally, the deeper the bed of fuel, and consequently the longer the period of contact of the carbonic acid with the fuel, the more will be the amount of carbonic oxide formed. The only resource is, therefore, to burn the carbonic oxide formed by a subsequent supply of secondary air, and to store up the heat thus liberated in a manner in which it can be used during the next period of gas making. Further, however, the ideal conditions of blowing up the fire require the sensible heat of the flue gases formed to be turned to good purpose, as well as the heat of combustion of the carbonic oxide. This cannot be completely achieved, but should be aimed at. The ideal conditions for the "blow" having been taken into account, the most efficient way of conducting the "run" or gas making must be ascertained.

Now, assuming that steam is injected beneath a coke fire in the generator, the products are either carbonic acid and hydrogen or carbonic oxide and hydrogen, according to the temperature. At 600° C., they are almost exclusively the first; but as the temperature becomes higher, the proportion of carbonic acid gradually diminishes and that of carbonic oxide rises, until, at about 1,100° C., the products are almost solely carbonic oxide and hydrogen. But even if a sufficiently high temperature is maintained in the generator to insure the reaction being $C + H_2O = CO + H_2$, nevertheless some carbonic acid will result if undecomposed steam passes through the fire, owing to steam and carbonic oxide reacting at temperatures above 600° C. to form hydrogen and carbonic acid. But while as a fact it is difficult wholly to avoid the passage of undecomposed steam through the fire, especially if the fuel bed is shallow, it is bad not merely because it conduces to the formation of carbonic acid, but also because it is costly, and withdraws heat from the generator—the specific heat of steam at the high temperature of the generator being nearly double what it is at ordinary temperatures.

If the rate of flow of the steam is kept low, the evil named is avoided. But the capacity of the apparatus is limited. Consequently, the only course is to let the carbonic acid be formed and the steam pass through, and subsequently to remove the one and utilize the other in some other way. There are many ways of removing the carbonic acid; but they are all costly. Another fact to be remembered is that while it has hitherto usually been the custom to employ coke which has been produced in coal gas manufacture for making water gas, it may be more advantageous under many circumstances to use other local fuel, conditionally on the layer in the generator being so shallow that it does not become unusable by reason of clinker.

The conditions which must be observed in the intermittent process of water gas manufacture, in order to secure as large a yield and as economical a procedure as possible, have now been indicated; and it only remains to refer to one of the most recent types of plant in the construction of which these conditions have been kept in mind. It comprises two pairs of generators, with, for choice, also a recuperator for preheating the air for each pair. The two recuperators always communicate with one another by means of a connection; while each is connected at the top with the corresponding generator. The generators are lined in the usual manner, and present as large reacting surfaces as possible. They discharge into a common recuperator, which serves alternately for cooling the spent gases and preheating the air supply. The air main from the recuperator branches to the generators, and supplies the primary air to the lower and the secondary air to the upper of the two vessels. The steam for gas making enters below the fire in the two generators, and at top and bottom of the recuperators. The gas exit pipes pass beneath the grates into a collecting main, which takes the gas to the condensing apparatus. The connections between the generators and the recuperator and the gas outlet pipes can, of course, be shut off by valves, which are all controlled from one point.

For a "blow," the air inlet to the generator and the connection with the recuperator are opened. The cold air enters the recuperator and is warmed by passing through it in the opposite direction to that taken by the hot spent gases. The heated air then flows into the generators. As the depth of the fuel is very shallow—only 2 feet 3½ inches in an experimental apparatus for an output of 4,400 cubic feet per hour—the combustion mainly results, if the blast is properly regulated, in the formation of carbonic acid. Owing to the high temperature of the fuel, however, there is always partial reduction to carbonic oxide; but the latter is burnt by means of a secondary supply of air, and the heat thus liberated, together with the sensible heat of the flue gases, is stored in the recuperator and given up later to the air supply. Owing to the small depth of the fuel bed, however, there will not be much carbonic oxide to be burnt, and the quantity of heat stored in the recuperators will not be unduly great, though with proper construction a high temperature may be attained.

The heat from the "blows" is thus utilized as economically as possible in the apparatus; for, in the first place, complete combustion is accomplished mainly in the fire itself, and, in the second place, nearly all the heat of combustion of the carbonic oxide formed by reduction is taken up in the apparatus.

At the end of a "blow," the recuperator and air valves are shut, and steam is injected at the bottom of the first generator, and into the two recuperators; while the gas connection from the second generator is opened. Water gas is produced in the first generator, and with some carbonic acid and undecomposed steam, passes into the recuperators,

where the introduced steam reacts with the carbonic oxide in the water gas and forms carbonic acid and hydrogen. If the process stopped here, the product would naturally be a very inferior one; but the mixture passes on to the second generator, and the carbonic acid is there completely reduced. This procedure is best in regard to the quality of the gas made, because the steam, entering the first generator, comes finally in the second generator in contact with the hottest parts of the fire, and, consequently, the decomposition of the carbonic acid takes place so energetically that tests show it is absent from the water gas made during the first half of the "run" or make of gas. The whole of the component parts of the plant are cooling while gas is being made—*i. e.*, the first generator is cooled by the formation of water gas, the recuperators by the incoming steam and its decomposition, and the second generator by the reduction of the carbonic acid. Thus the whole system is ready to take up heat during the ensuing "blow." The arrangement presents the important advantage that the second generator is cooled less, and therefore the better effects its work as a reducing chamber; while, when the blow takes place, it becomes far the hottest, and is, therefore, best adapted to serve as the water gas producing chamber during the next "run." So, in two successive runs, the parts played by the two generators are exchanged.

During the "blows" the two generators are used in parallel, and during the "runs" in series. The alternating course of the gas through them presents a further advantage in preventing the formation of troublesome clinker. The low depth of the fuel bed admits of the "blows" being made extremely short, and also gives the advantage that lean or even caking coal may be used in the generators. The disadvantage presented by the shallowness of the bed—viz., that steam passes through it undecomposed, thus abstracting much heat from the fire, and either condensing as such or increasing the proportion of carbonic acid in the gas—is done away with in this plant, because the steam and carbonic acid are brought into contact with incandescent fuel in a reducing chamber before reaching the outlet of the apparatus. The amount of steam admitted, and, consequently, the capacity and adaptability to demands of the plant, may be varied considerably at will with out the composition of the gas or the amount of steam used being greatly affected.

The use of tar producing fuels is either out of the question in other systems of water gas manufacture, or entails the employment of tar extractors, etc., as in the case of carburetted water gas plant. But the present system allows such fuels to be used merely on condition that they are introduced before a run into the generator which is about to serve as the first in the series. The hot water gas then distils the fuel, and the products pass into the recuperators, where they are fixed or react with steam. When the apparatus is used in this manner, it is a good thing to admit steam to the upper part of the generator where the fuel is being distilled. The last trace of tar, etc., will in any case be destroyed in the second generator.

The advantages of the process referred to are, briefly, that, during the "blow," when the generators work in parallel, the fuel bed is shallow, and, consequently, yields mainly carbonic acid and is rapidly heated up, any carbonic oxide formed is burnt and the heat stored up, and the air for the blast is preheated; while during the "run," when the generators work in series, undecomposed steam from the generator is utilized for reacting with carbonic oxide in the recuperators to form carbonic acid, which is subsequently reduced in the second generator. The recuperators are thus cooled, the steam and gases are brought in contact with the hottest part of the fire, the direction of flow is reversed after each run, and the rate of flow of the steam may be varied within wide limits to suit the desired output. Further, gas coal may be used in the apparatus without risk of tar being produced; and inferior and caking fuel may also be used.

An experimental plant, capable of making 4,400 cubic feet per hour, has been worked at Dongen, in Holland. In addition to the apparatus with boiler, blower and gas engine, there were also a scrubber, a relief gasholder, a purifier, a gas meter, and a large holder. The trials were made with this plant at first under the observation of a certifying committee, consisting of Professor H. W. Bakhuis Rooneboom, of Amsterdam, Heer J. Blom, the Manager of the Haarlem Gas Works, and the author. The results were, however, so remarkable that Heer D. van der Horst, the General Manager of the Amsterdam Gas Works, after visiting the plant decided to send the chemist with his assistants from those works to study a 14 days' run with the plant. The appended figures are taken from his report.

The temperatures determined with the pyrometer were: The generators, after blowing, about 800° C.; the flue gases, at the outlet of the recuperator, average 250° C.; the gases escaping from the second generator, 500° C.; and the air for the blast at the inlet to the generator, 170° C. There were produced 5,160 cubic feet of gas per hour from about 117 pounds of coal consumed in the generator, or the consumption per 1,000 cubic feet of gas made was 22.7 pounds of coal, containing 18.95 pounds of carbon. The calorific power of the gas was 2,871 calories gross, or 2,626 calories net per cubic meter (322 B.T.U. gross or 295 B.T.U. net per cubic foot). The average composition of the gas was—

Carbonic acid	1.1	volumes per cent.
Carbonic oxide	43.2	"
Hydrogen	49.0	"
Marsh gas	1.0	"
Nitrogen	5.4	"
Oxygen	0.3	"

The steam used for gas making amounted to 37½ pounds per 1,000 cubic feet of gas made. Coal was employed instead of coke in order to test the value of the fixing process. No tar was deposited either in the collecting main or purifying vessel.

A brisk discussion followed the announcement of these results, and an esteemed English opponent said that in the first place the trial was only a laboratory experiment, and in the second place that the calorific output of the system was, according to the figures, over 100 per cent. As to the first contention, while a 4,400 cubic feet per hour apparatus is not indeed a large one, it is large enough to give trustworthy figures. The second contention was based on a calculation of the heat balance, which ignored the hydrogen in the coal—amounting in this instance to 4.5 per cent.—and the steam produced outside the generator. A sound calculation of the heat balance would be—

1 pound of coal, having a calorific power of		14,760 B.T.U.
And 1.53 pounds of steam at 150° C.	=	1,795 "
Giving therefore a total value of		16,555 "
Yield slightly over 44 cubic feet of water gas of a calorific power of 322½ B.T.U. per cubic foot	=	14,155 "
Making the loss	=	2,400 "

Consequently, the efficiency of the apparatus is

$$\frac{14{,}155 \times 100}{16{,}555} = 85.5 \text{ per cent.}$$

This extremely high efficiency is to be ascribed to: (1) The advantages of the system as already indicated; and (2) the fact that the spent gases remaining in the recuperators also pass into the gasholder after the blows—the carbonic acid in them being reduced to carbonic oxide in the second fire.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE gas plant at Circleville, O., is to be rebuilt. The contract for the work has been awarded to Mr. John Lockwood.

MESSRS. M. W. FINDLAY and George Brown have purchased the franchises for the gas and electric lighting supply of Corona, Cal.

THE residents of Aledo, Ills., are agitating the matter of the construction of a gas plant.

AT the organization meeting of the Directors of the Lancaster Railway and Light Company, which concern controls the gas, electric lighting and trolley systems of Lancaster county, Pa., the following officers were chosen: President, William B. Given; Vice-President, Charles B. Keller; Secretary and Treasurer, O. M. Hoffman.

AT the annual meeting of the Boone (Ia.) Gas Company, the following officers were elected: President, E. G. Pratt, Milwaukee, Wis.; Vice-President, George D. Roper, Rockford, Ills.; Secretary and Treasurer; E. C. Brown, N. Y.; Assistant Secretary, H. E. Martin.

AT a meeting of the Directors of the Taunton (Mass.) Gas Light Company, Mr. Walter T. Soper, formerly Clerk of the Company, was elected its Treasurer, vice the late Mr. Henry B. Leach. Mr. Ralph E. Fish, formerly Assistant Superintendent, was elected Superintendent.

THE by-laws offered by the Common Council of Calgary, N. W. T., granting to Messrs. D. Morris & Company the right to there operate a gas works, has been indorsed by vote of the ratepayers.

THE Massachusetts Board of Gas and Electric Light Commissioners has issued an order authorizing the Lawrence Gas Company to furnish electricity to the residents of Andover. The Board has also authorized the Nantucket (Mass.) Gas Light Company to engage in the supplying of electric currents.

THE Alton (Ills.) Railway, Gas and Electric Company is now in complete control of the Alton street railway, gas and electric plants by a consolidation perfected about a week ago. The Alton and East Alton Railway and Power Company, owning the projected line to East Alton and all franchises pertaining thereto, is to be merged with the older Company. The consolidation is for the purpose of carrying out some big projects the Company has on hand, including an extension of the East Alton line to East St. Louis and the building of additional electric lines in Alton.

MR. M. I. FROST, Manager of the Salisbury (N. C.) Gas and Electric Light Company, has been using up much of his energies in the bettering of the gas division of the Company's service. In the course of this laudable work much overhauling has been done, and while new construction has been performed it was only sensible to agree that any of the "old stuff" that withstood the ravages of time should be kept in service. The net result of the cleaning out of an old tar tank seems to have been this, as told by a correspondent: "Mr. Frost's men took out four musket barrels, all in good shape, an army musket in fine shooting trim, one 6-inch cannon ball, a 9-inch shell (filled), a breech-loading musket, made of bronze, a sword, an artilleryman's sabre, and many minie balls. There were four bayonets in the 'recoveries' that were actually as good as new. The latter fact, as a gas man, I think goes to show that tar is the great preservative, even fit for the thought of ex-Schwab and active Corey, of steel and iron current fame. The Frost actual find is now shown in the office of the Salisbury Company, which concern is proving to the residents of that place that gas hath its victories no less renowned than those of oil—kerosene or otherwise."

AT the annual meeting of the Fall River (Mass.) Gas Works Company no change was made in the executive management, Mr. Henry R. Hayes having been elected Clerk and Mr. Henry B. Sawyer, Treasurer.

AT the annual meeting of the shareholders of the Gas Consumers Association, of San Francisco, Cal., the officers chosen were: President, D. L. Randolph; Vice-President, J. D. Whitney; Secretary, Henry Krebs; Assistant Secretary and Auditor, T. B. Lyman; Manager, C. P. Pomeroy. Under the "revised selling rate" in San Francisco, brought about by the efforts of the "Honolulu Baby," we fear that shares in the Gas Consumers Association will shortly be speckled.

THE Monterey (Cal.) County Gas and Electric Company has been incorporated with a capitalization of $750,000. The reputed Directors are: M. V. Quigg, C. W. Allen, R. C. P. Smith, of Los Angeles; J. M. Gardiner, of Santa Cruz; and Cora E. Hubbell, of Ontario.

THE average consumption of gas per meter per year in Manchester, N. H., is returned at 5,000 cubic feet. Pretty good for a far New England city.

COL. E. G. PRATT, the clever Manager of the Milwaukee (Wis.) Gas Light Company, has made an improvement in the collecting of gas accounts in that city which seems to have escaped the gaze of the all-pervading eye of his predecessor. The change amounts to this, as per the official notification: "Heretofore, as is generally known, all meters have been read within a certain period toward the close of the month, in order to have bills ready for presentation on the 1st of every month. This required the services of not only a large number of our own office force, but we have had to temporarily engage many others who were found capable to read a meter. Under the plan adopted the Company has divided the city into three districts for the performance of this work. The meter readers will be uniformed and will be practically at work taking the meters all the time. Under this arrangement bills in District No. 1 will be presented on the 10th of each month; those in District No. 2 will be presented on the 20th, and those in District No. 3 will be rendered on the last or the 30th of the month, the last discount day for payment being on the 20th for the first, 30th for the second, and 10th for the third district. In order to put this into practice bills for the present month will in reality be but for 10 days in District No. 1; 20 days in No. 2, and the full month in No. 3. This change, however, will enable the Company to keep up the work of meter reading continuously by an experienced uniformed corps of employees, and this system will also reduce the matter of errors to the minimum."

MR. E. G. RUNYAN, the successor to Dr. S. Calvert Ford, as inspector of gas and meters for the District of Columbia, for the twelvemonth ended June 30th, has submitted his report. The main facts shown in the document are: "The average illuminating power of gas required by law during the year was 22 candles. The mean average shown at the various stations for testing the illuminant furnished by the Washington Gas Light Company was 23.08 candles, or 1.08 candles above the legal requirements. Gas furnished by the Georgetown Company averaged 23.77 candles. Sulphuretted hydrogen has not been present in any of the gas since last March. During the year ending June 23, 1903, this office inspected and proved 5,751 gas meters. With the exception of 7 meters for the Alexandria gas works and 1 for use at Fort Myer, all the meters were inspected for the Washington and Georgetown Gas Light Companies and consumers of gas supplied by these two Companies. Of the meters tested 2,810 were new meters and 1,306 were repaired ones. Thirty-seven meters were tested on the complaint of consumers in Georgetown; of this number 13 were fast, average error, 4.31 per cent.; one registered 3 per cent. slow, and 23 were correct. Three meters were tested on complaint of the Georgetown Gas Light Company. Of this number one registered 4 per cent. fast, one registered correctly, and one failed altogether to register the gas that passed through it. On complaint of consumers in Washington 967 meters were inspected, of which 430 registered fast, average error 3.30 per cent., 449 registered correctly and 2 failed to register at all. On complaint of the Washington Gas Light Company there were inspected 628 meters, of which 17 registered fast, average error, 4.47 per cent.; 361 registered slow, average error, 25.02 per cent.; 23 registered correctly, and 227 failed to register at all. Of the 1,004 meters inspected on complaint of the consumers 443, or 44.12 per cent. registered fast; 89, or 8.86 per cent. either failed to register or registered slow, and 472, or 47.01 per cent., registered correctly. Of the 631 meters inspected on complaint of the gas companies 18, or 2.85 per cent., registered fast; 361, or 57.21 per cent., registered slow; 24, or 3.80 per cent., registered correctly, and 228, or 36.13 per cent., failed to register at all. These complaint meters cannot be taken as fair representatives of the meters now in service in the District of Columbia, as these meters were ordered out for test on complaint of either the Company or the consumer because they were suspected of failing to register the correct amount of gas passing through them."

THE new plant at Beaver Dam, Wis., will be completed by October 15th, so its contractors say. If it is ready by December 1st good and quick work will have been done.

A CORRESPONDENT forwards the following, under date of July 29th: "That the Pittsfield (Mass.) Coal Gas Company has had a remarkably successful year was shown by the reports submitted at the annual meeting held this morning in the office of the treasurer. The concern has branched out in many lines, and voted to make certain improvements that will add materially to the operating capacity of the Morningside plant. The old board of officers was re-elected as follows: President, Robert W. Adam; Treasurer and Clerk, William R. Plunkett; Directors, Robert W. Adam, William R. Plunkett, James W. Hull, William G. Backus and George H. Tucker. During the year the gas mains have been extended to Dalton, and the inhabitants of that town express much satisfaction with the new system. The number of consumers is daily increasing, while a boom is being experienced in the matter of gas stoves, a large number of which have been disposed of. The amount of gas manufactured was nearly 50,000,000 cubic feet, an increase of nearly 100 per cent. over last year. The Company had on July 1 over 2,000 meters set. It was voted to direct the Board of Directors to remove the water gas apparatus building from Water street to Beaver street, and locate the same east of the present coal gas plant, and connect it with the holder on the south side. The Directors have had some negotiations for a lot west of the present gas house, but no satisfactory price can be obtained for it and, as the Company has sufficient land east and south of the present works, the shareholders voted to occupy that. The object of this reconstruction of the water gas plant is to have a supplementary source of supply in case of failure in the coal gas supply or any other emergency. The work is to be untaken this year. Financially the Company has had a prosperous year. It was fortunate in having a brisk demand for coke, the receipts from which source being nearly $12,000. The Company has now covered with its mains almost all the streets of the old fire district. It has relaid its distributing pipes in North and West streets on account of the proposed paving. At a subsequent meeting of the Directors, Ralph Woodward was continued as General Manager and John F. Dunbar as Superintendent of Meters. A dividend of 3 per cent. was declared. The capital of the Company will be increased August 15 by the issue of 650 new shares, making the capital of the Company $190,000."

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

MONDAY, AUGUST 10, 1903.

The Market for Gas Securities.

The slaughtering was well maintained in "securities" of all sorts last week. With the rest Consolidated went down, as Mr. J. P. Morgan would say. Looking for a reason explanatory of the slump in accredited gas shares, one rather irreligious gas man (he resides in Brooklyn) said he knew of nothiug that could explain the situation other than that Leo XIII. had been succeeded by Pius X. In the interim, fathers Stillman and Rockefeller have not had much luck in corralling Brooklyn Union gas. Brother Rogers still has an anchor to windward therein. Deepwater sailor that he is, let us hope that im mersion will not cut short his breath.

The quotations for local gas shares are simply ridiculous. Consolidated at 172 to 173½; Brooklyn Union at 190 to 195. The usual quarterly dividend of 2 per cent. on the former has been declared. The unique feature of the market is Peoples, of Chicago. Its main loss in the down movement has been only 16 per cent., and Brother Billings has been speeding his horses while Brother Rockefeller has been saying his prayers. Washington gas looks cheap.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

AUGUST 10.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$78,177,000	100	172	173½
Central Union, Bonds, 5's.	3,000,000	1,000	109	111
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan Bonds	658,000	.	108	112
Mutual	3,500,000	100	299	320
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co. ..				
Bonds, 5's	11,000,000	1,000	107½	108
Northern Union, Bonds, 5's.	1,250,000	1,000	106	107
New York and East River				
Bonds 1st 5's	3,500,000	1,000	110	118
" 1st Con. 5's	1,500,000		109	111
Standard	5,000,000	100	135	140
Preferred	5,000,000	100	155	170
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	190	195
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	⅛	2/16
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	3¾	4¼
" " Bonds, 5's	5,250,000	1,000	73	76
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central, San Francisco	1,900,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	96	96½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¾	89¼
Preferred	3,026,500	100	107½	109
Consumers, Jersey City Bonds	600,000	1,000	100	102
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	66½	68
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	85	87
Consolidated G. & E. Co.'s.				
Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,825,500	50	87	95
" Prior Lien 5's	5,603,000	1,000	99¼	100
Detroit Gas Co., 5's	532,000	1,000	77	79
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	56	60
" Bonds, 6's	2,650,000	..	104¾	106
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	79	90
Preferred	2,500,000	100	85	..
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100	.	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	130	140
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108¼
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	300	325
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	.
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	91¼	91¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	.
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	0,000,000	100	51½	52
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	95	96¼
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	113½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047.000	1,000	98¼	99½
Washington, D. C	2,600,000	20	297½	300
First mortgage 6's	600,000	..	..	..
Western, Milwaukee.				
Bonds, 5's	4,000,000	..	109½	110
Wilmington, Del.	600,000	50	232	

Advertisers' Index.

GAS ENGINEERS.

	Page
A. E. Boardman, New York City	232
Baxter & Young, Detroit, Mich.	232
B. E. Chollar, St. Louis, Mo.	222
David Leavitt Hough, New York City	232
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	234
Frank D. Moses, Trenton, N. J.	218
Fred. Bredel Co., Milwaukee, Wis.	22
Geo. R. Rowland, New York City	222
Humphreys & Glasgow, New York City	233
Kerr Murray Mfg. Co., Fort Wayne, Ind.	232
The Gas Machinery Co., Cleveland, O.	219
The Jeffrey Manufacturing Co., Columbus, O.	216
The Western Gas Construction Co., Fort Wayne, Ind.	240
United Gas Improvement Co., Philadelphia, Pa.	237
Wm. Henry White, New York City	235

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City	232
Bartlett, Hayward & Co., Baltimore, Md.	233
Baxter & Young, Detroit, Mich.	232
Christopher Cunningham, Brooklyn, N.Y.	229
Connelly Iron Sponge and Governor Co., New York City	228
Continental Iron Works, Brooklyn, N. Y.	234
Cruse-Kemper Co., Philadelphia, Pa.	219
Davis and Farnum Mfg. Co., Waltham, Mass.	232
Deily & Fowler, Philadelphia, Pa.	236
Economical Gas Apparatus Construct'n Co., Toronto, On.	234
Frank D. Moses, Trenton, N. J.	218
Fred. Bredel Co., Milwaukee, Wis.	220
G. Shepard Page's Sons, New York City	232
Humphreys & Glasgow, New York City	233
Isbell-Porter Company, New York City	234
Kerr Murray Mfg. Co., Fort Wayne, Ind.	232
Lloyd Construction Co., Detroit, Mich.	232
Logan Iron Works, Brooklyn, N. Y.	236
Quintard Iron Works, New York City	233
R. D. Wood & Co., Philadelphia, Pa.	234
Riter-Conley Mfg. Co., Pittsburg, Pa.	235
Stacey Mfg. Co., Cincinnati, O.	235
The Connersville Blower Company, Connersville, Ind.	237
The Gas Machinery Co., Cleveland, O.	219
The Jeffrey Manufacturing Co., Columbus, O.	216
The Western Gas Construction Co., Fort Wayne, Ind.	240
United Gas Improvement Co., Philadelphia, Pa.	237

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md.	233
B. E. Chollar, St. Louis, Mo.	222
Economical Gas Apparatus Construct'n Co, Toronto, Ont	234
Humphreys & Glasgow, New York City	233
The Gas Machinery Co., Cleveland, O.	219
The Western Gas Construction Co., Fort Wayne, Ind.	240
United Gas Improvement Co., Philadelphia, Pa.	237

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N.Y.	234
Kerr Murray Mfg. Co., Fort Wayne, Ind.	232
Logan Iron Works, Brooklyn, N. Y.	236
R. D. Wood & Co., Philadelphia, Pa.	234
Riter-Conley Mfg. Co., Pittsburg, Pa.	235
Stacey Mfg. Co., Cincinnati, O.	235
The Gas Machinery Co., Cleveland, O.	219
The Western Gas Construction Co., Fort Wayne, Ind.	240

PRODUCER POWER PLANTS.

R. D. Wood & Co., Philadelphia, Pa.	234

TAR AND CARBONIC ACID EXTRACTOR.

Stacey Mfg. Co., Cincinnati, O.	235
The Gas Machinery Co., Cleveland, O.	219
The Western Gas Construction Co., Fort Wayne, Ind.	240

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich.	216
The Gas Machinery Co., Cleveland, O.	219
The Western Gas Construction Co., Fort Wayne, Ind.	240

GAS METERS.

American Meter Co., New York and Philadelphia	239
Detroit Meter Company, Detroit, Mich.	239
D. McDonald & Co., Albany, N.Y.	237
Helme & McIlhenny, Philadelphia, Pa.	239
John J. Griffin & Co., Philadelphia, Pa.	200
Keystone Meter Co., Royersford, Pa.	238
Maryland Meter and Mfg. Co., Baltimore, Md	238
Metric Metal Co., Erie, Pa.	239
Nathaniel Tufts Meter Co., Boston, Mass.	238

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia	239
D. McDonald & Co., Albany, N. Y.	237
Helme & McIlhenny, Philadelphia, Pa.	239
John J. Griffin & Co., Philadelphia, Pa.	200
Keystone Meter Co., Royersford, Pa.	238
Nathaniel Tufts Meter Co., Boston, Mass.	238

PREPAYMENT METER ATTACHMENTS.

Reeves Mfg. Co., New Haven, Conn.	240

GAS AND WATER PIPES.

Charles Millar & Son Co., Utica, N. Y.	224
Christopher Cunningham, Brooklyn, N.Y.	229
Davis & Farnum Mfg Co., Waltham, Mass.	232
Donaldson Iron Co., Emaus, Pa.	224
M. J. Drummond & Co., New York City	224
R. D. Wood & Co., Philadelphia, Pa.	234
Warren Foundry and Machine Co., New York City	224

NON-RUSTING PIPE LUBRICANT.

Alan H. Tripp, Chicago, Ills.	216

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila.	230
Perkins & Co., New York City	230
Westmoreland Coal Co., Philadelphia, Pa.	231

SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa..... 221

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N.Y. City..... 224

GAS TAPPING MACHINES.

George Light, Dayton, O.. 224
H. Mueller Manufacturing Company, Decatur, Ills..... 221

CANNEL COALS.

Perkins & Co., New York City..... 230

STOKING MACHINERY.

G. A. Bronder, New York City..... 229

AUTOMATIC WEIGHING MACHINERY.

Richardson Scale Co., New York City..... 220

CONVEYORS.

C. W. Hunt Company, New York City..... 221
G. A. Bronder, New York City..... 229
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 232
The Gas Machinery Co., Cleveland, O..... 219
The Jeffrey Manufacturing Co., Columbus, O..... 216
The Link-Belt Machinery Co., Chicago, Ills..... 231
The Western Gas Construction Co., Fort Wayne, Ind... 240

CHARGING BARROWS & COAL WAGONS.

Kerr Murray Mfg. Co., Fort Wayne, Ind..... 232
Stacey Mfg. Co., Cincinnati, O..... 245

GAS ENRICHERS.

Standard Oil Co., New York City..... 231
The Sun Oil Co., Pittsburg, Pa..... 231

COKE CRUSHERS.

C. M Keller, Columbus, Ind..... 231
The Jeffrey Manufacturing Co., Columbus, O..... 216

STEAM BLOWER FOR BURNING BREEZE.

The Connersville Blower Company, Connersville, Ind... 237

ECONOMIZERS.

Green Fuel Economizer Co., Matteawan, N.Y..... 222

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 216

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 223
Isbell-Porter Co., New York City..... 234
R. D. Wood & Co., Philadelphia, Pa..... 244

CEMENTS.

C L. Gerould, Galesburg, Ills..... 228

RETORTS AND FIREBRICKS.

Adam Weber Sons, New York City..... 228
Baltimore Retort and Firebrick Co., Baltimore, Md..... 228
Brooklyn Firebrick Works, Brooklyn, N. Y..... 224
Henry Maurer & Son, New York City..... 223
James Gardner, Jr., Co., Pittsburg, Pa..... 224
J H Gautier & Co., Jersey City, N. J..... 224
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 228
Missouri Firebrick Co., St. Louis, Mo..... 224
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 217
The Kreischer Brick Mfg. Co., New York City..... 228

(*Continued on page* 216.)

MANAGER,

AT LIBERTY OCTOBER 1ST.

Experienced, energetic young man; thoroughly practical gas man and an economical manager. Good record.

1470-2 Address, "B. H.," care this Journal.

Position Wanted

As Superintendent or Assistant in Coal or Water Gas Plant,

By capable and energetic young man. Excellent references.

1470-1 Address, "G. F. S.," care this Journal.

Position Wanted.

Young man, of 12 years' experience in the successful management of gas plants, desires position as manager or superintendent of medium size plant, or foreman of manufacturing department of large size works.

1470-3 Address, "PENN," care this Journal.

POSITION WANTED.

Young Man Wishes Position with Progressive Company.

Can take charge of works, street work, or any department in plant.

1470-1 Address, "DEPT.," care this Journal.

POSITION WANTED

By a young man, to take charge of new business department and make himself generally useful, in a city of about 10,000 inhabitants, in California. Thoroughly understands all gas appliances, running of mains and services, testing and adjusting meters. An expert at engineering the piping of old houses. Can design special appliances for any practical purpose. Will accept position after Oct. 1, where hustler will be appreciated. State opportunities. First-class references given. Address, "O. Y.," care this Journal.

1469-3

WANTED,

Position as Manager of a Gas Company

That is much in need of a man thoroughly familiar with all details of the business. A position where the business and public confidence are much impaired, requiring the right man, at the right place, at the right time, preferred.

1462-tf Address, "ABILITY," care this Journal.

POSITION WANTED

AS MANAGER or SUPERINTENDENT,

By a successful hustler for new business. Experienced in selling gas stoves; laying high and low pressure mains; understands the manufacture of coal and water gas in detail; also, reconstruction of benches and water gas apparatus. Superintendent of gas company for a number of years. Will find me up-to-date and energetic young man. Can furnish best of references. Address,

1470-5 "PUSHER," care this Journal.

Position Wanted

As Superintendent in Charge of a Small Gas Plant.

Technical graduate with 3½ years' experience in the works of the United Gas Improvement Company. Address, "K. B. M.,"

1469-2 Care this Journal.

Position Wanted

BY A PRACTICAL GAS MANAGER.

Fifteen years' experience in construction, manufacture and distribution of both coal and water gas in various types. Also able to inventory and place the business and office records upon an improved and proper basis of accounting; being practical and successful in all details of the business. Address, "PROGRESS,"

1469-tf Care this Journal.

WANTED,

SECOND-HAND STATION METER,

Suitable for gas company manufacturing from 3 to 4 million cubic feet of gas per year. Give manufacturer's name, capacity and condition. Price figured on, F. O. B.

Address, GEO. W. GRAVES, care "THE HICKS,"

1465-tf Asbury Park, N. J.

METER FOR SALE.

One 300-Light Maryland Meter.

The Maryland Meter Company will vouch for good condition of this meter. For particulars, address,

1468-tf OTTAWA GAS LIGHT & COKE CO., Ottawa, Ills

FOR SALE.

ONE NO. IV. ROOT ROTARY EXHAUSTER.

Reason for selling: Too small. Can be seen in operation at these works.

DAYTON GAS LIGHT AND COKE COMPANY,

1470-tf DAYTON, O.

FOR SALE.

One High Pressure Roots' Exhauster and Engine,

On one bed. This machine is practically new, and has been delivering 100,000 per day, through 8 miles of 4-inch pipe line. Engine is direct connected to exhauster, and with them is included one cooling tank and all 8-inch connections.

1467-tf Address, "F. R. V.," care this Journal.

FOR SALE.

Two Rectangular, Cast Iron, Water Tube Condensers, 5 feet 6 inches wide, by 15 feet 10 inches high, by 36 feet 10 inches long, with 20-inch valves and connections.

One Rectangular, Cast Iron Scrubber, 5 feet 6 inches wide, by 12 feet high, by 36 feet 10 inches long, with 20-inch valves and connections.

Sixteen Sections of Cast Iron Hydraulic Main, 8 feet 4 inches long by 24 inches, for benches of 5's; dip and bridge pipes; 7-inch ascension pipes; supports for hydraulic main; 4 take-off ends, with 12 inch outlets; adjustable valves, with Hutchison tar draw-off pots.

Seventy-eight Self-Sealing Mouthpieces, each 18 by 24.

One Fuller Vertical Engine, 8 by 12, with exhauster governor.

One Fuller Vertical Engine, 9 by 14, with exhauster governor.

One McKenzie Exhauster, 16-inch valves and connections.

One Wilbraham Exhauster, 16-inch valves and connections

One 12-inch By-Pass, with Smith & Sayre compensator; 6-inch connections.

One P. & A. Tar Extractor, 1,000,000 cubic feet capacity; 16-inch connections

One Wrought Iron Tower Scrubber, 6 feet diameter by 29 feet 6 inches high; 16-inch valves and connections.

Two Wrought Iron Scrubbers, 7 feet diameter by 16 feet high, with 16-inch valves and connections.

Three Wrought Iron Condensers, each 6 feet diameter by 16 feet high, with 16-inch valves and connections.

Two Standard Washer-Scrubbers, No. 13, with 20-inch valves and connections

All the above apparatus, if examined at once, can be seen connected and in operation. It will be removed to give room to larger apparatus. Any further information can be obtained from the PROVIDENCE GAS COMPANY,

1462-tf Providence, R. I.

FOR SALE,

Two Settings of Single Superheater Lowe Water Gas Apparatus.

Address,

WILLIAMSPORT GAS COMPANY,

1463-tf WILLIAMSPORT, PA.

NOTICE TO BIDDERS.

BOARD OF PUBLIC WORKS,
KANSAS CITY, MO., August 6th, 1903.

Sealed bids will be received at the office of Secretary of Board of Public Works, at City Hall, Kansas City, Mo., up to 2 o'clock, P.M., Monday, August 17th, 1903, for furnishing the following:

One Thousand Incandescent Gas Burners for street lamps, capable of giving 60-candle power light. Sample of burner must accompany bid.

A certified check for 5 per cent. of amount bid must be filed at same time as a guarantee that bidder who receives award will enter into contract.

The Board of Public Works reserves the right to reject any or all bids. ROBERT E. KING,

1470-1 SECRETARY BOARD OF PUBLIC WORKS.

Advertisement for Bids for Gas Franchise.

SUPERIOR, WIS., July 23, 1903.

Notice is hereby given that specifications have been adopted by the Common Council of the city of Superior, Wis., containing rules and regulations for the construction, maintenance and operation of a plant for the manufacture, distribution and sale of gas in said city for a period of 20 years, and that such specifications are now on file in the office of the City Clerk, at the City Hall in said city.

Sealed bids for the granting of a franchise, according to the terms of said specifications, stating the percentages of the gross receipt of the business to be carried on thereunder the bidder will pay annually into the treasury of said city for said franchise, will be received by the undersigned, until 12 o'clock, noon, Aug. 24, 1903, as provided by Section 940 of the Wisconsin Statutes of 1898.

All bids should be addressed or delivered to the undersigned City Clerk, at Superior, Wis. JOHN A. HOBEN.

1469-3

Gas Analyses of All Sorts and Conditions,

—OR—

Analyses of Solid and Liquid Materials as Well,

That are needed by Gas Companies at any time in the conduct of their business, may be obtained from

DR. W. H. BIRCHMORE,

1421-tf 341 ADELPHI ST., BROOKLYN, N. Y.

(*Concluded from page* 215.)

INCLINED RETORTS.

Adam Weber Sons (Graham, Morton [England] System) 228
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 223
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 217

VERTICAL S'S.

Adam Weber Sons (Oscar B. Weber's Construction)..... 218
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 223
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 217

REGENERATIVE FURNACES.

Adam Weber Sons, New York City..... 238
Bartlett, Hayward & Co., Baltimore, Md..... 233
Fred. Brodel Co., Milwaukee, Wis..... 240
J. H. Gautier & Co., Jersey City, N.J..... 228
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 228
Missouri Firebrick Co., St. Louis, Mo. 228
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 217

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N.Y. 234
Isbell-Porter Co., New York City..... 234
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 232
Logan Iron Works, Brooklyn, N.Y..... 236
R. D. Wood & Co., Philadelphia, Pa..... 234
Stacey Mfg. Co., Cincinnati, O..... 235
The Gas Machinery Co., Cleveland, O..... 219
The Western Gas Construction Co., Fort Wayne, Ind... 240

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... 238

INCANDESCENT GAS LAMPS.

Ball Check Light Co., New York City..... 218
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 220
Welsbach Company, Gloucester, N. J..... 236

BURNERS.

C. A. Gefrorer, Philadelphia, Pa..... 220
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 220
Wm. M. Crane Co., New York City.. 221

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 220

STREET LAMPS.

Thos. T. W. Miner, New York City..... 221
Welsbach Street Lighting Co., New York and Phila.... 236

PURIFIERS.

Connelly Iron Sponge and Governor Co., New York City. 223
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 232
R. D. Wood & Co., Philadelphia, Pa..... 234
Stacey Mfg. Co., Cincinnati, O..... 235
The Western Gas Construction Co., Fort Wayne, Ind... 240

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 223

VALVES.

Continental Iron Works, Brooklyn, N. Y..... 234
Isbell-Porter Co., New York City..... 234
Kerr Murray Mfg. Co., Fort Wayne, Ind 232
Ludlow Valve Manufacturing Co., Troy, N.Y..... 221
R. D. Wood & Co., Philadelphia, Pa..... 234
Stacey Mfg Co., Cincinnati, O..... 235
The P. H. & F. M. Roots Co., Connersville, Ind..... 183
The Western Gas Construction Co., Fort Wayne, Ind.... 240

EXHAUSTERS.

Connelly Iron Sponge and Governor Co., New York City 223
Isbell-Porter Company, New York City..... 234
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 232
The Connersville Blower Company, Connersville, Ind... 233
The P. H. & F. M. Roots Co., Connersville, Ind.... 183

ELECTRICAL APPARATUS.

Wm. Henry White, New York City..... 235

PURIFIER SCREENS.

John Cabot, New York City..... 220

GAS STOVES.

American Meter Co., New York and Philadelphia..... 225
Keystone Meter Co., Royersford, Pa..... 238
Maryland Meter and Manufacturing Co., Baltimore, Md. 238
Nathaniel Tufts Meter Co., Boston Mass..... 238

HOT WATER HEATERS.

The Humphrey Mfg. and Plating Co., Kalamazoo, Mich. 224

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N.Y..... 222

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 233
Continental Iron Works, Brooklyn, N.Y..... 234
Cruse-Kemper Co., Philadelphia, Pa. 219
Davis & Farnum Mfg. Co., Waltham, Mass..... 232
Deily & Fowler, Philadelphia, Pa..... 236
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 232
Logan Iron Works, Brooklyn, N.Y..... 236
R. D. Wood & Co., Philadelphia, Pa..... 234
Riter-Conley Mfg. Co., Pittsburg, Pa. 235
Stacey Mfg. Co., Cincinnati, O..... 235

STORAGE TANKS.

Christopher Cunningham, Brooklyn, N.Y..... 219
Stacey Mfg. Co., Cincinnati, O..... 235

AUTOMATIC SCALES.

Richardson Scale Co., New York City..... 220

INVESTORS.

W. R. Faben Construction Company, Toledo, O..... 220

PATENTS, TRADE-MARKS, COPYRIGHTS.

Royal E. Burnham, Washington, D. C..... 220

Utilize Your Gas Liquor.

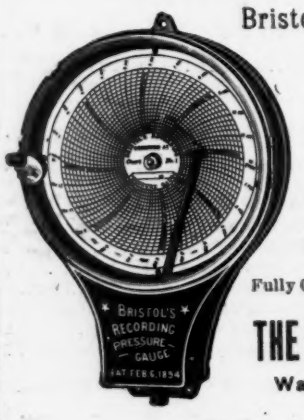
NO EXTRA LABOR OR OPERATING EXPENSES.

IMPROVED AMMONIA CONCENTRATOR.

About 100 in use. Write to

STROH & OSIUS, Patentees, or

MICHIGAN AMMONIA WORKS, - Detroit, Mich.



Bristol's Recording

PRESSURE GAUGE.

For continuous records of **Street Gas Pressure.** Simple in construction, accurate in operation and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,

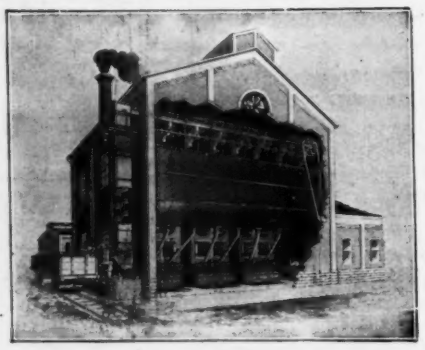
Waterbury, Conn.

Silver Medal, Paris Exposition.

JEFFREY COAL AND ASHES HANDLING MACHINERY.

MAY WE SEND YOU A COPY OF OUR CATALOGUE?

Shaking Screens.
Dump Cars.
Chains, all styles and sizes.
Elevator Buckets.
Sprocket Wheels.
Coal and Coke Crushers.
Elevators of all kinds.



Power Transmission Machinery.
Cable Conveyors.
Spiral Conveyors.
Rubber Belt Conveyors.
Conveyors of all kinds.

A Most Complete Installation, Including Crusher, Combined Elevator and Conveyor with Storage Tank. Capacity, 500 Tons of Coal.

We are prepared to handle your material rapidly and economically, in Bulk or Package, Wet or Dry, Hot or Cold, Up, Down, Straight Along, Sidewise, Any Size, Any Distance.

Address, **THE JEFFREY MANUFACTURING COMPANY,**
COLUMBUS, OHIO, U. S. A.

New York, Denver, Buffalo, Philadelphia, Butte, Mont., Kansas City, St. Louis, New Orleans, Mobile, Pittsburg, Charleston, W. Va.

For Gas Pipe Threads Use

TRIPP'S celebrated Non-Rusting PIPE LUBRICANT. Sold on an absolute 30-day guarantee to be superior and cheaper to any Pipe Cement or Red and White Lead. The only material that does not harden up in can when mixed. 50-lb. pail shipped on 30-day trial F.O.B. Chicago, $4.75. Will do the work of 150 lbs. of Red Lead.

REFERENCES.—The Peoples Gas Light and Coke Co., Chicago. . . The Jacksonville Gas Co., Jacksonville, Ills. . . Canton Gas Co., Canton, Ills. . . Galesburg Gas Co., Galesburg, Ills., etc., etc. . . The Bloomington Gas Co. writes: June 26, 1903—Alan H. Tripp, Chicago, Dear Sir: In placing our second order for your Non-Rusting Pipe Lubricant, we wish to say that the sample pail you sent us proved to be satisfactory in every way, which accounts for this second order. Yours truly, Union Gas and Electric Co., J. A. Wilcox, President, Bloomington, Ills.

☞ Order a sample 50-lb. pail to-day.

ALAN H. TRIPP,
The Gasfitters' Friend.

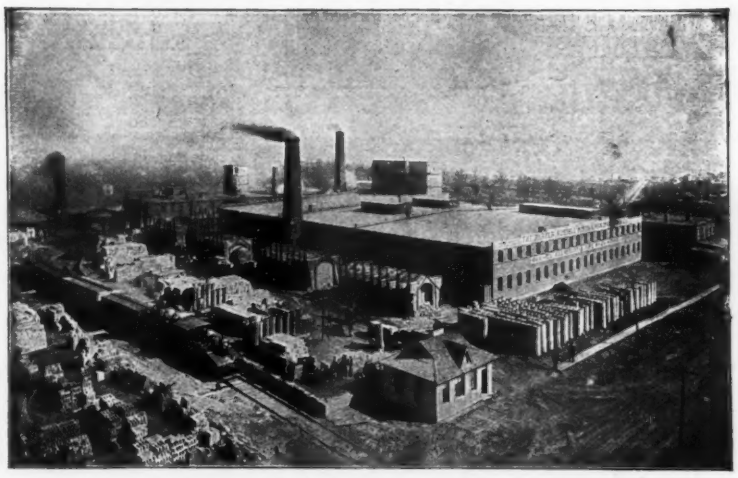
ALAN H. TRIPP,
Sole Inventor and Manufacturer,
177 East 40th Street, Chicago, Ills.
TELEPHONE, DREXEL, 3043.

PARKER-RUSSELL MINING AND MFG. CO.,

PROPRIETORS OF THE

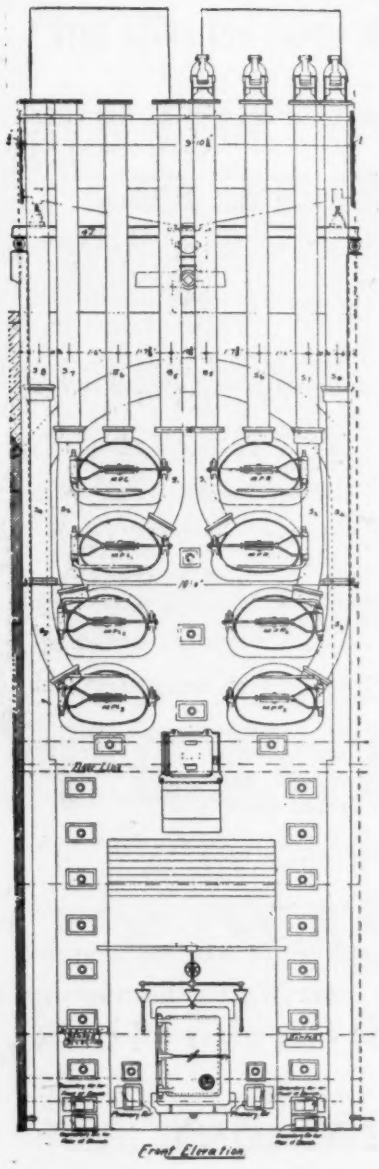
OAK HILL GAS RETORT AND FIREBRICK WORKS.

St. Louis Office:
417 Pine St.



FACTORY AT ST. LOUIS, MO.

New York Office:
Aldrich Court,
45 Broadway.



WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

SLOPERS.--We have perfected plans of INCLINED RETORT BENCHES, designed to meet conditions prevailing in America, and constructed entirely of American materials.

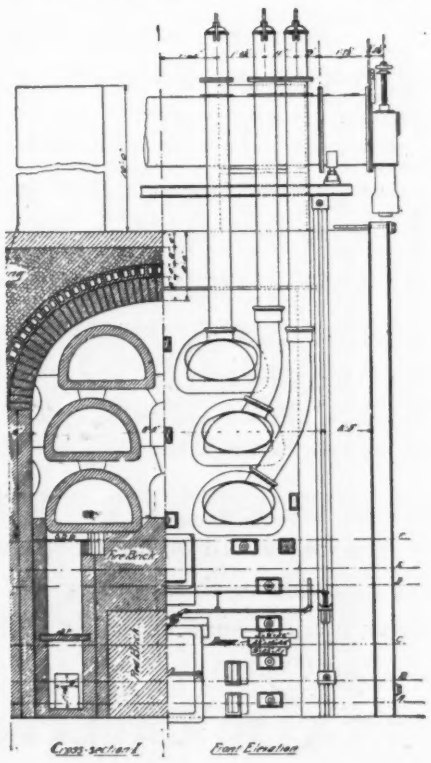
We build Benches complete, ready for gas making. Also

RETORT HOUSES,

COAL AND COKE CONVEYING MACHINERY.

Plans, Specifications and Estimates cheerfully furnished.

CORRESPONDENCE SOLICITED.



SAMPLE
BALL CHECK
By Mail
(To Dealers)
For a Dime.
They Sell For
A Quarter.

BOOKLET
OF OUR
GAS ARC
LAMPS
for the
Asking.

FRANK D. MOSES,

Long Distance Telephone, 1922, Trenton, N. J.

TRENTON, N. J.,

Long Distance Telephone, 1922 Trenton, N. J.

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE.

CORRESPONDENCE SOLICITED.

SCIENTIFIC BOOKS.

FLECTRIC GAS LIGHTING. By H. S. Norrie. 50 cents.

GAS ANALYST'S MANUAL. By J. Abady. $6.50.

COX'S GAS FLOW COMPUTER. $2.50.

FIELD'S ANALYSIS, 1902. $5.

HUGHES' GAS WORKS. $1.65.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor $3.50.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

PRACTICAL TREATISE ON HEAT. By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

HEMPEL'S GAS ANALYSIS, $2.25.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

COAL: Its History and Use. By Prof. Thorpe. $3.50.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfeld. $1.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5.

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

GAS LIGHTING AND GAS FITTING. By W. P. Gerhard. 50 cents.

PRACTICAL PLUMBING. By P. J. Davies. $3.

AMERICAN PLUMBING. By Alfred Revill. $2.

CEMENT; A Manual of Lime and Cement, their Treatment and Use in Construction. By A. H. Heath. $2.50.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.60.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKETBOOK. By Monroe and Jamieson. $2.50.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK.

P. PLANTINGA, President. W. E. STEINWEDELL, Secretary.

THE GAS MACHINERY CO.,

OFFICES: 720-722 CITIZENS BUILDING,

CLEVELAND, OHIO.

Coal and Water Gas Apparatus, Bye-Product Machinery, Structural Work and Connections.

ARTHUR R. CRUSE, President. FRANK FLAVELL, Secretary. AARON E. KEMPER, Treasurer.

Cruse-Kemper Company,

PHILADELPHIA OFFICES: Stephen Girard Building. - - WORKS: Ambler, Pa.

Manufacturers of

Triple, Double and Single-Lift Gasholders,

With or Without Metal Tanks,

Oil and Water Tanks, Purifier Covers, General Plate Metal Work, and Steel Water Towers.

Plans, Specifications and Estimates Promptly Furnished on Request.

COX'S HIGH-PRESSURE FLUID DISCHARGE COMPUTER.

This Computer solves the following formula, which is applicable to Gas, Air and other elastic fluids, flowing through long pipes with high initial pressures:

$$\text{Discharge in cubic feet per hour at atmospheric pressure} = 33.3\sqrt{\frac{d^5 \times (p_1^2 - p_2^2)}{L \times w}}$$

Where d = diameter of pipe in inches,
p_1 = absolute initial pressure in pounds per square inch,
p_2 = absolute terminal pressure in pounds per square inch,
L = length of pipe in miles,
w = specific gravity of the fluid when air = 1.

To Find the Discharge from a Pipe and the Required Size of Pipe.

(1.) Set the specific gravity of the fluid opposite the length of pipe;
(2.) Bring the DIFFERENCE of the initial and terminal gauge pressures opposite the SUM of the initial and terminal gauge pressures;
(3.) Opposite any diameter of pipe will now be found the discharge in cubic feet per hour at atmospheric pressure; and
(4.) Opposite any desired discharge will also be found the required diameter of pipe.

Price of the Computers, in Cloth Case, 6½ x 8 inches, $5 Each, Net.

A. M. CALLENDER & CO., 42 PINE ST., N. Y.

PRACTICAL PHOTOMETRY,

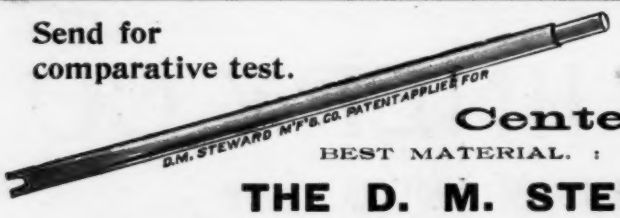
A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.

By WILLIAM JOSEPH DIBDIN.

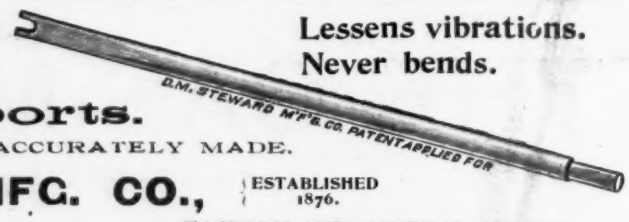
With Numerous Illustrations. Price, $3.00.

A. M. CALLENDER & CO., 42 Pine Street, New York City.

Send for comparative test.



LAVITE
(TRADE MARK)
Center-Supports.
BEST MATERIAL. : : : : : : ACCURATELY MADE.



Lessens vibrations. Never bends.

THE D. M. STEWARD MFG. CO., ESTABLISHED 1876.

NEW YORK: 8-12 Jay Street. CHICAGO: 57 Washington Street. FACTORY AND GENERAL OFFICE: Chattanooga, Tenn. 8

IN THE MARKET.

WE PURCHASE:
Gas properties,
Electric light properties.
Street railway properties.
Also desirable franchises.

W. R. FABEN CONSTRUCTION CO.,
1383-tf 317 St. Claire Street, Toledo, O.

GAS BURNERS,

To burn a given amount at a stated pressure made to order. Samples furnished. Also, small oil and air valves, slow-feed valves for high pressure, and small brasswork in general.

Drip Pumps, Service Cleaners, Gasfitters' Proving Pumps and Mercury Gauges.

C. GEFRORER & SON,
248 North 8th Street, Philadelphia, Pa.

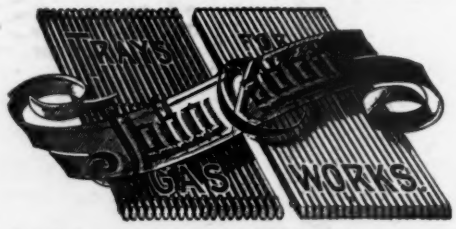
PATENTS, TRADE-MARKS, COPYRIGHTS.

ROYAL E. BURNHAM,
Solicitor of Patents and Counsellor in Patent Causes.
833 Bond Building, Washington, D. C.

Send for Pamphlet on Patents.
1418 tf

AUTOMATIC
Send for Catalogue.
SCALES
RICHARDSON SCALE CO., 21 Park Row, NEW YORK CITY.

Church's Patent Trays.
Reversible; Strongest; Most Easily Repaired.
Special Trays for Iron Sponge.



1412-1416 Adams Street, Hoboken, N. J.
We also Supply the Chapest and Strongest
•Reversible Bolted Trays•
IN THE MARKET.
SEND FOR BOOKLET AND CIRCULARS.

ORDER

The **REEVES PREPAYMENT ATTACHMENT** sent to your meter manufacturers; they will attach them. Or order from us and attach them yourselves. The Reeves Prepay has advantages possessed by no other. Ten hours' warning to consumers. Can't be "beaten." Simple. Low price. Now being used by scores of the largest gas companies. Write for sample and descriptive matter.

REEVES MFG. CO., - - - NEW HAVEN, CONN.

FRED. BREDEL, President. WM. O. VILTER, Vice-President. O. W. GREENSLADE, Secretary and Treasurer.

FRED. BREDEL COMPANY,
ENGINEERS AND BUILDERS OF GAS PLANTS.
Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.
Special High Grade Material for Recuperative Furnaces.
Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. OFFICE, 405 KEENE ST., MILWAUKEE, WIS.

COAL TAR AND AMMONIA.

THIRD AND ENLARGED EDITION.

BY

GEORGE LUNGE, PH.D.

Price, $15. For Sale by

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

Bray Burners.

Said the Sun to the Sky:
"For the present, Good-bye!
"I'll see you to-morrow at four"
But when he came back
What had happened? Alack!
There's no use for the sun any more!

Said the Sky to the Sun:
"All your glory is done,
"Hide your face and don't make a row,
"For a chappie named BRAY
"Has turned night into day
"BRAY BURNERS will light the world now!"

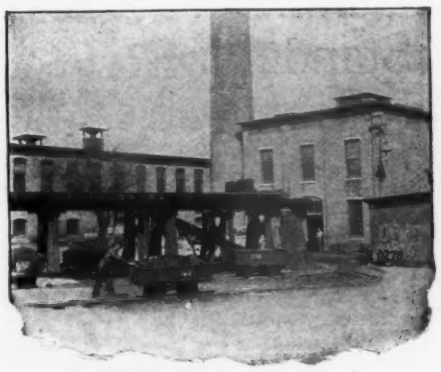
Bray Burners are the one burner you can always rely upon as being of uniform quality and greatest candle power.

Beware of Imitations.

William M. Crane Company,

Sole Agents for the United States,

1131-1133 Broadway, New York.



Boiler room charging cars and tracks.

Write for Catalog 0227.

"Industrial"

(Trade-mark)

Railways

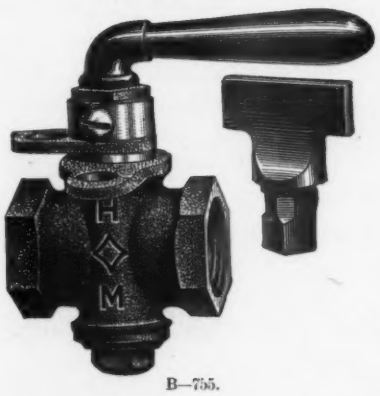
For the economical and rapid handling of coal in boiler rooms. A narrow gauge railway, equipped with cars, designed so that they run around a curve of 12 feet radius as easily as a wagon turns a corner.

C. W. HUNT COMPANY,

WEST NEW BRIGHTON, STATEN ISLAND, N. Y.

New York Office: 45 Broadway.

Mueller Gas Cocks.



B—755.

TOO little is not as much as you pay for, and too much is more paid for than you need.

In **Mueller Gas Cocks** you find a happy medium--not so little metal as to leave them weak, nor yet so much as to make them costly.

Made in 145 styles, seven sizes in each style.

MADE ONLY BY

H. MUELLER MFG. CO.,

DECATUR, ILLS., U. S. A.

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

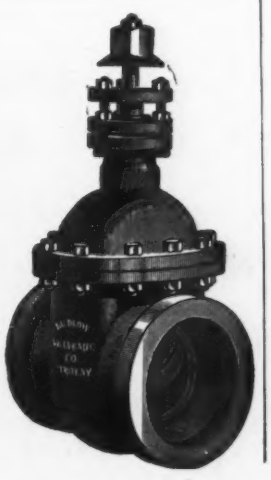
Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.



"THE MINER"

Globe

Street and Boulevard

Lamps.

Cheapest and Best.

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

Send for Catalogues.

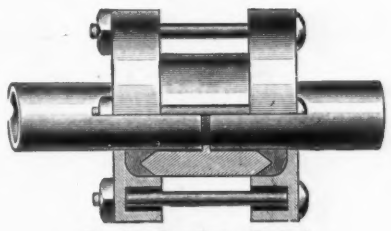
THOMAS T. W. MINER,

821-823 Eagle Av., N.Y.

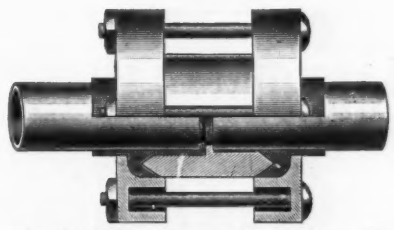
S. R. DRESSER,

BRADFORD, PENNSYLVANIA, U. S. A.,

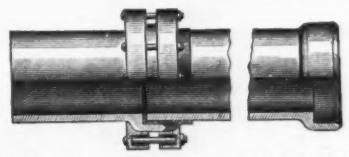
Patentee and Manufacturer of Specialties for Oil and Gas Lines.



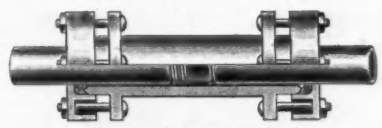
Regular Coupling. Style 1.



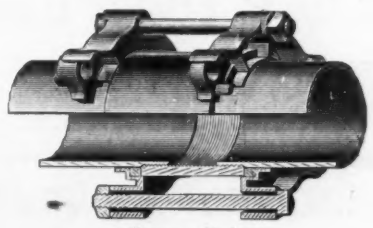
Insulating Coupling for Wrought Iron Pipe. Style 3.



Insulating Coupling for Dresser Bell and Spigot Cast Iron Pipe. Style 6.



Regular Sleeve. Style 2.



Clamp. Style 4.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

LLOYD CONSTRUCTION COMPANY,

DETROIT, MICH.

LOWE DOUBLE SUPERHEATER WATER GAS APPARATUS.

Coal Gas Condensing and Scrubbing Apparatus.
Purifiers with Plain or Reversing Center Valves.
The Lloyd System of Valve Connections.
PLAIN OR REVERSING (PATENT APPLIED FOR).
Oxide, Coal and Coke Elevators and Machinery.
Pipe Specials, all sizes. A. G. L. Asn. Standard.
Structural Steel Work, Floors, Angle and Gate Valves.

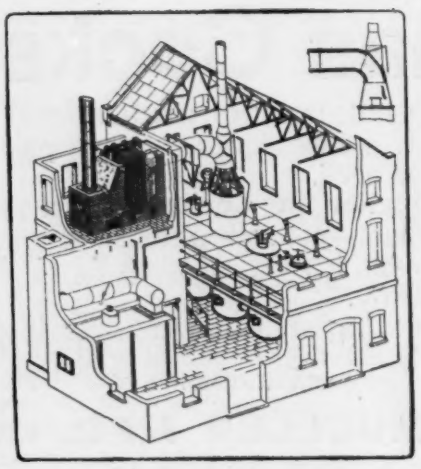
General Western Agents for BARTLETT, HAYWARD & CO., Baltimore, Md.

COAL GAS CONDENSATION SYSTEM. THE "MAYER" PATENTED TAR EXTRACTOR. THE STANDARD ROTARY WASHER-SCRUBBER. STETTIN SYSTEM INCLINED BENCHES, HYDRAULIC VALVES, ETC., ETC.

Economize Heat in Water Gas Plants,

BY UTILIZING A

Green's Economizer,



To absorb the heat now going to waste when you blow through your superheater to heat the feed water for your boilers to the temperature of the steam. This is now being done at the Poughkeepsie Gas Works, Poughkeepsie, N. Y. : : : : :

Write for full particulars how this is accomplished, the saving effected, and the advantages gained, to the

GREEN FUEL ECONOMIZER CO.,
MATTEAWAN, N. Y.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

THE GAS ENGINEERS' POCKET-BOOK.
By Henry O'Connor,
Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.
PRICE, $3.50.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City.

The Advertisement of the

P. H. & F. M. ROOTS CO., Mfrs. of Gas Exhausters, Blowers, etc.,

Connersville, Ind., - - - 120-122 Liberty Street, New York City,

Occupies this Space Every Alternate Week.

Connelly Iron Sponge and Governor Co.,

395 Broadway, New York City.

TELEPHONE, 3033 Franklin. - - - CABLE ADDRESS, Governorco.

GEO. G. RAMSDELL, General Manager. S. F. HAYWARD, Treasurer.

DRAKE'S
System of
INCLINED or
HORIZONTAL
RETORTS.

Erected on
Guaranteed
Results.

Also Complete
COAL and COKE
HANDLING
MACHINERY.

Gas Exhausters,
Gas Governors,
Photometers,
Iron Sponge,
Revivifying Air Device,
Gas Specialties.

CONTRACTORS FOR EVERY KIND OF GAS WORKS PLANT.

"Elbow Specials, Quick Repairs, etc."

M. J. DRUMMOND & CO.

MANUFACTURERS OF

CAST IRON

FLANGE

GAS and WATER PIPE

"Clarorgan" Fire Hydrants

GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

GEORGE ORMROD, Manst. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

CAST IRON GAS & WATER PIPE

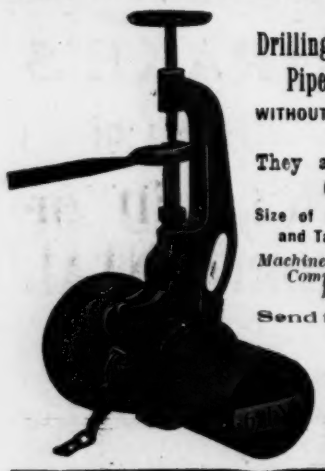
MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES



—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light, DAYTON, O.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS, SPECIFICATIONS AND ESTIMATES PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

THE

Valuation of Gas, Electricity and Water Works

FOR ASSESSMENT PURPOSES.

THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.

With an Appendix of Decided Cases.

Second Edition. Price $2. For Sale by

A. M. CALLENDER & CO.,
42 Pine Street, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

CHARLES MILLAR & SON CO., Selling Agents, Utica, N.Y.

Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.

UTICA PIPE FOUNDRY CO.

Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers' and Tinners' Goods.

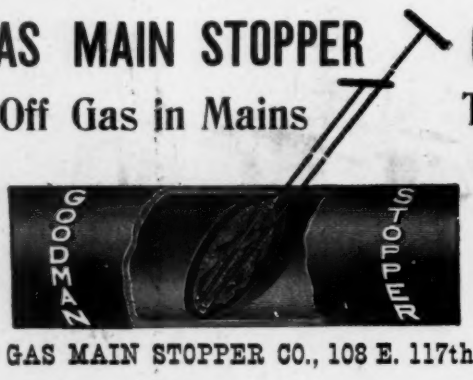
CAST IRON PIPE and SPECIALS FOR WATER AND GAS.

Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :



Temporarily during alterations and repairs. : : : :

STOPPERS SENT ON TRIAL.

Address: SAFETY GAS MAIN STOPPER CO., 108 E. 117th St., New York City.

THE No. 8

Humphrey Crescent Instantaneous Water Heater

IS A QUICK SELLER.

PRICE,

$20.00.

SHELF AND BRACKET FREE.

HAS NO EQUAL AT THE PRICE.

TRY ONE AND BE CONVINCED. WILL SEND ON 60 DAYS' APPROVAL.

HAVE YOU OUR CATALOGUE?

The Humphrey Mfg. and Plating Co.,

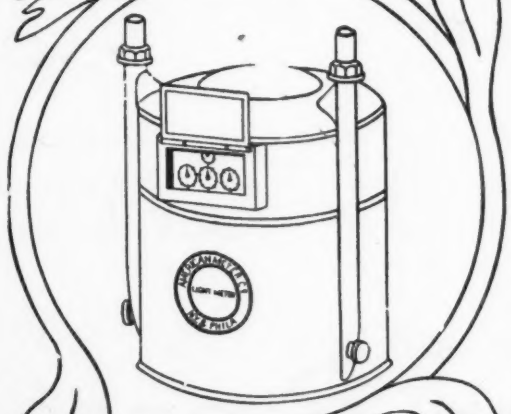
KALAMAZOO, MICH., U. S. A.

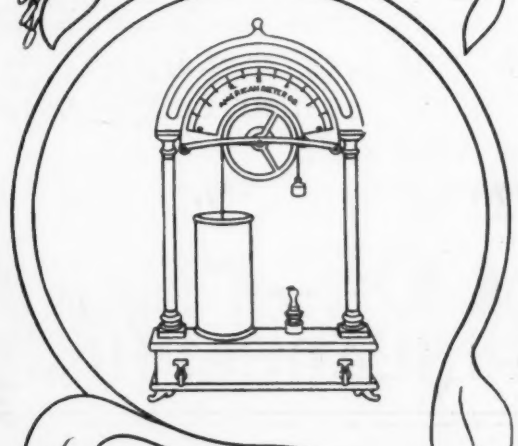
(Copyrighted, 1894, by the AMERICAN METER CO.)

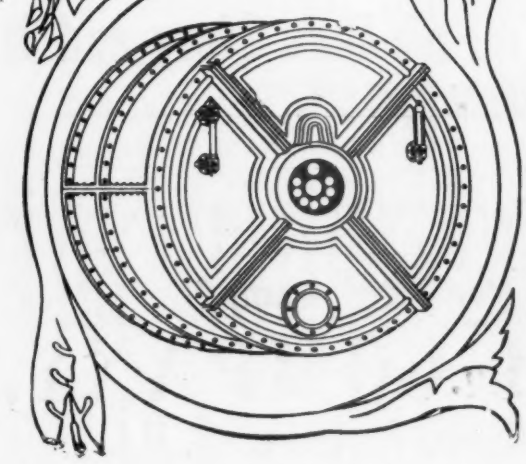
AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK,
PHILADELPHIA,
CHICAGO,
ST LOUIS,
SAN FRANCISCO.



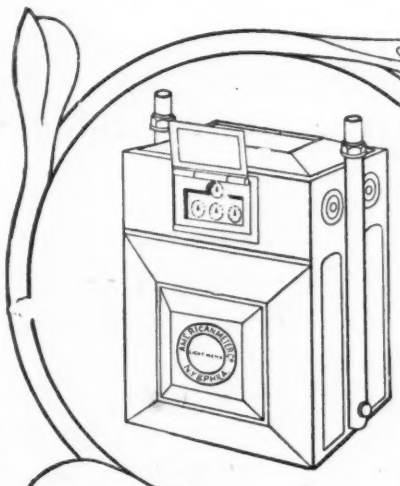


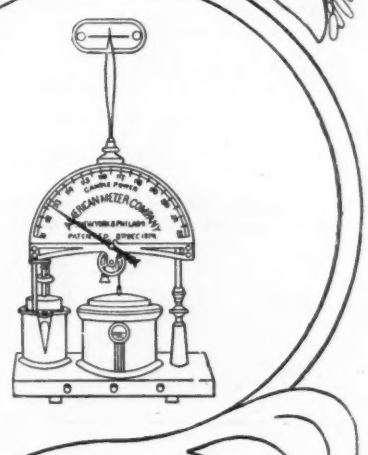


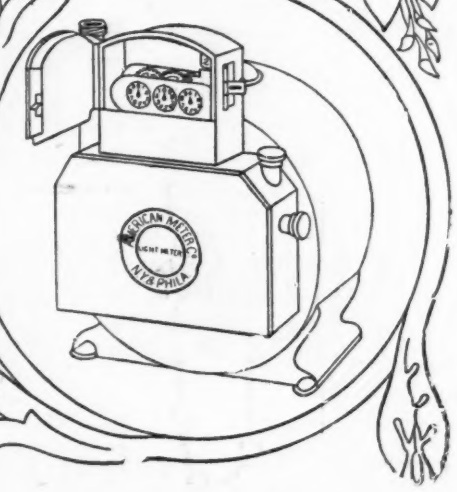
PUBLIC LIGHTING TABLE.

AUGUST, 1903.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Sat.	1	11.20 PM	3.50 AM	7.10	3.30
Sun.	2	12.10 AM	4.00	7.10	3.30
Mon.	3	1.00	4.00	7.10	3.30
Tue.	4	1.40	4.00	7.10	3.30
Wed.	5	2.30	4.00	7.10	3.30
Thu.	6	No L.	No L.	7.10	3.45
Fri.	7	No L. FM	No L.	7.10	3.45
Sat.	8	No L.	No L.	7.10	3.45
Sun.	9	7.30 PM	8.40 PM	7.10	3.45
Mon.	10	7.30	9.10	7.10	3.45
Tue.	11	7.30	9.40	7.10	3.45
Wed.	12	7.30	10.10	7.10	3.45
Thu.	13	7.30	10.40	6.55	4.00
Fri.	14	7.30	11.20	6.55	4.00
Sat.	15	7.30 LQ	11.50	6.55	4.00
Sun.	16	7.20	12.40 AM	6.55	4.00
Mon.	17	7.20	1.30	6.55	4.00
Tue.	18	7.20	2.30	6.55	4.00
Wed.	19	7.20	4.10	6.55	4.00
Thu.	20	7.20	4.10	6.45	4.10
Fri.	21	7.20	4.10	6.45	4.10
Sat.	22	7.20 NM	4.10	6.45	4.10
Sun.	23	7.10	4.20	6.45	4.10
Mon.	24	7.10	4.20	6.45	4.10
Tue.	25	7.10	4.20	6.45	4.10
Wed.	26	7.10	4.20	6.45	4.10
Thu.	27	8.40	4.20	6.30	4.20
Fri.	28	9.20	4.20	6.30	4.20
Sat.	29	10.00 FQ	4.20	6.30	4.20
Sun.	30	10.50	4.30	6.30	4.20
Mon.	31	11 40	4.30	6.30	4.20







TOTAL HOURS LIGHTING DURING 1903.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	245.00	January	423.20
February	192.00	February	355.25
March	201.00	March	355.35
April	167.20	April	298.50
May	152.00	May	264.50
June	131.00	June	234.25
July	140.40	July	243.45
August	156.20	August	280.25
September	171.20	September	321.15
October	198.20	October	374.30
November	216.30	November	401.40
December	232.10	December	433.45
Total, yr.	2203.40	Total, yr.	3987.45

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple-

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

Broad and Arch Sts., PHILADELPHIA.

The Welsbach Gas Arc for Indoor Lighting.

The cut tells the story—but not all of it. Get one lamp and light it—then the tale's told from beginning to end. For one Welsbach Gas Arc Lamp is a better salesman than 20 pages of advertising.

Here's what it would show if you give it a chance to prove its worth:

1. A mechanical construction and finish that insures the greatest durability.
2. The renewal of mantles and the cleaning of globes without removal of globe.
3. The greatest amount of candle power with least consumption of gas.
4. A by-pass cock so constructed as to permit all or only one mantle burning at a time.
5. A pilot light that consumes but 1 foot of gas in 24 hours. Costs $\frac{1}{10}$ of a cent a day.

Give it a Chance to Tell its Own Story and it Won't Disappoint.

Let us send you one lamp—doesn't cost a fortune—and it will answer every question you put to it; make good on every test given it. You know the only proof of the pudding? What's the use in a fellow telling you it tastes good? Taste it yourself, then you know.

May we Send you ONE Lamp?

WELSBACH COMPANY,

GLOUCESTER, N. J., and CHICAGO, ILL.

THE UNITED GAS IMPROVEMENT COMPANY

For the Six Months Ending July 1, 1903, has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Rochester, N. Y.	Brooklyn, N. Y.	Waltham, Mass.
Baltimore, Md.	Hempstead, N. Y.	Dover, Del.
Chicago, Ills.	Chester, Pa.	Allentown, Pa.
Amesbury, Mass.	Lynn, Mass.	Savannah, Ga.
Aberdeen, S. D.	Newark, N. J.	New York (Central Union Co.)
Winsted, Conn.	Washington, D. C.	Cicero, Ills.
Canon City, Col.	Boone, Ia.	Chicago (Ogden Co.)
Schenectady, N. Y.	Pueblo, Col.	Easton, Pa.
Hagerstown, Md.	Charlotte, N. C.	Lawrence, Mass.
Malden, Mass.	Fall River, Mass.	Council Bluffs, Ia.
Bridgeport, Conn.	Duluth, Minn.	Chattanooga, Tenn.
Albert Lea, Minn.	New York (Mutual Co.)	

TOTAL SETS TO JULY 1, 1903, ... 51
TOTAL DAILY CAPACITY, ... 55,150,000 cubic feet.
TOTAL SETS TO DATE, ... 498
TOTAL DAILY CAPACITY, ... 354,830,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES, FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF
CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office:
Cor. Manchester and Sulphur Avenues, St. Louis, Mo.

Established 1845. Reorganized 1902.

The Kreischer Brick Mfg. Co,

Manufacturers of the very best quality of Clay Retorts, Blocks, Tiles, Settings and Firebrick of every description.

Also Miners and Shippers of Fireclay, Fire Sand, Ground Brick in Barrels.

WORKS: KREISCHERVILLE, STATEN ISLAND.
OFFICE: 119 E. 23D STREET, NEW YORK CITY.

Adam Weber Sons.

Works, Weber, N. J.
Main Offices, Park Row Bldg., New York.

Modern Recuperative Furnaces.

Standard Fire Brick and Gas Retorts.

OSCAR B. WEBER'S

Construction Vertical 8's (Patented).
First Instalment in the World with Modern Charging and Discharging Machinery.

AGENTS FOR

GRAHAM, MORTON & CO.
LEEDS ENGLAND,
INCLINED RETORT SYSTEM.

Perforated Radial Block Chimneys.

AGENCIES.
HERBERT B. HAM, 80 Water Street, Boston, Mass.
BAKER ENGINE AND MACHINE CO., 114 N. 3d St., Phila., Pa.
JOHN T. WHEELER, 933-934 Monadnock Bldg., Chicago, Ills.

ISAAC C. BAXTER, President. ESTABLISHED 1861. PETER YOUNG, Sec'y and Treas.

Works,
LOCKPORT STATION, PA.

JAMES GARDNER, JR., CO.,

Address all communications to
JAMES GARDNER, JR., CO., Room 202 Lewis B'l'dg.
PITTSBURGH, PA

Successor to WILLIAM GARDNER & SON.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. Galesburg, Ills., or Buffalo, N. Y.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, Galesburg, Ills.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

The Gas Engineer's Pocket-Book,

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

For Sale by

A. M. CALLENDER & CO., 42 Pine Street, New York City.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT

Our Improved Half and Full Dept Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** **The Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office:
411 Olive Street,
Continental Bank,
ST. LOUIS, MO.

CHRISTOPHER CUNNINGHAM,

PROPRIETOR.

THE NOVELTY STEAM BOILER WORKS,

BROOKLYN, N. Y.

STORAGE TANKS FOR GAS WORKS,

To Retain Fluid Material of Any Sort.

PIPING IN AND AROUND GAS WORKS.

Work Done for Several of the Largest Gas Companies in America Stands as Reference.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.

Four-Scoop and Four-Rake Charging and Discharging Machines are being furnished for Detroit, Mich.

These are the only machines that will draw or charge simultaneously three or four retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Can., working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

G. A. BRONDER,

Contracting Engineer and Builder,

229 BROADWAY, NEW YORK.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming. .

A. C. M. AZOY, General Agent, 1 Broadway, New York.

THE GAS ENGINEER'S POCKET-BOOK,

By HENRY O'CONNOR,

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

FOR SALE BY

A. M. CALLENDER & CO., - No. 42 Pine Street, New York City.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

WITH A VERY FULL COLLECTION OF TABLES OF HEATS OF COMBUSTION OF FUELS, SOLID, LIQUID AND GASEOUS.

TO WHICH IS ALSO APPENDED

THE REPORT OF THE COMMITTEE ON BOILER TESTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, DECEMBER (1897); TABLES OF CONSTANTS USED.

By HERMAN POOLE, F.C.S.

Second Edition. Price $8. For Sale by

A. M CALLENDER & CO. - - No. 42 Pine Street, New York City.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50.
For sale by

A. M. Callender & Co., 42 Pine St., N. Y.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., N.Y. CITY.

BINDER for the JOURNAL.

Price, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, N.Y.

EDMUND H. McCULLOUGH, President. CHAS. F. GODSHALL, Treasurer. H. C. ADAMS, Secretary. HENRY WHARTON, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

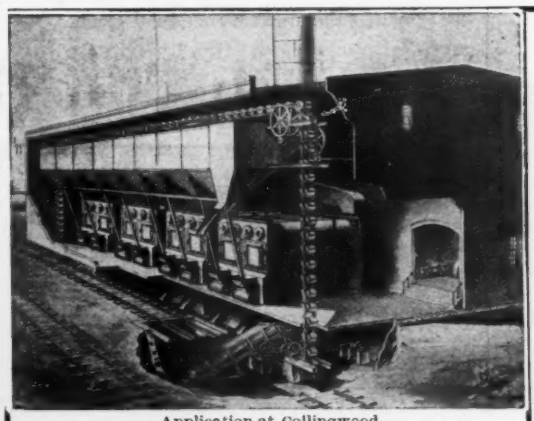
Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.



Application at Collingwood.
Shops L. S. & M. S. R. R., Cleveland, O.

LINK-BELT

Overlapping

PIVOTED BUCKET CARRIER.

(PATENTED.)

A single machine will handle both coal and ashes in boiler room. It is automatic, efficient, durable, occupies little space, and saves money. Can be adapted to a wide range of special conditions. : : : : :

Link-Belt Machinery Co.,

LINK-BELT ENGINEERING CO., Philadelphia. Chicago.

THE SUN OIL CO.

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

Toledo, O., and Pittsburgh, Pa.

Standard Oil Company,

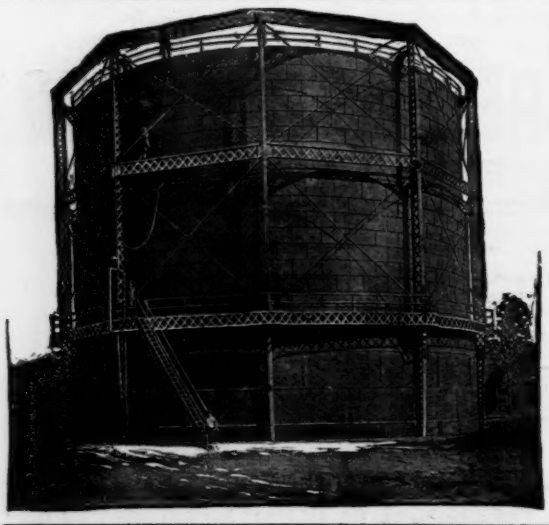
GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING,

Rooms 201 & 202. DETROIT, MICH.

A. E. BOARDMAN, C. E.,

Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

Edison Building, 42 and 44 Broad St.,

NEW YORK CITY.

Geo. Shepard Page's Sons.

GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

DAVID LEAVITT HOUGH,

Consulting Engineer

AND

CONTRACTOR,

PARK ROW BUILDING, N. Y.

Practical Photometry,

By William Joseph Dibdin

Price, - - - - $3.00.

FOR SALE BY

A. M. CALLENDER & CO.,

No. 42 Pine Street, New York City.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

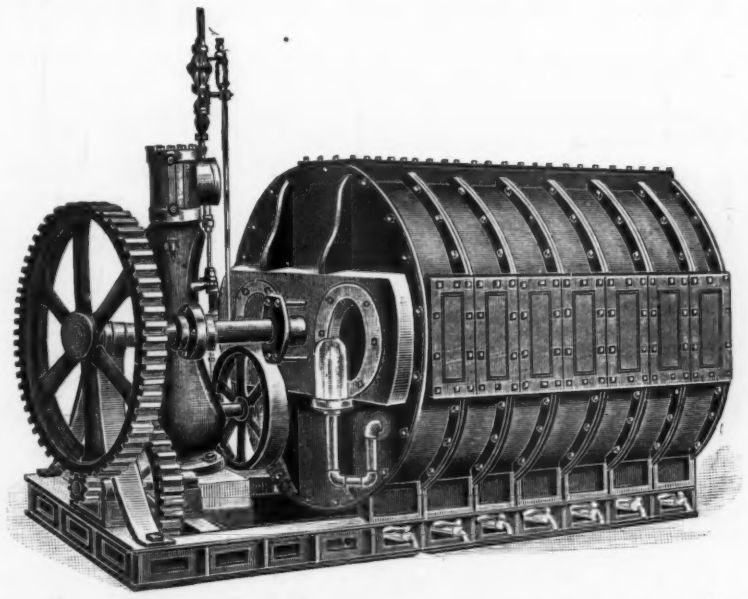
ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Designers and Builders of Gas Works.



Sole Lessees the Wilkinson Water Gas Process.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

Coal and Water Gas Installations of the Most Modern and Complete Types.

BENCHES WITH INCLINED RETORTS.

System Stettiner Chamotte Fabrik, Actien Gesellschaft, of Stettin, Germany.

GASHOLDERS OF ALL SIZES.

General Western Agents, THE LLOYD CONSTRUCTION CO., of Detroit, Mich.

QUINTARD IRON WORKS,

N. F. PALMER.

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

ALEX. C. HUMPHREYS, M.E., M. Inst. C.E. ARTHUR G. GLASGOW, M.E., M. Inst. C.E.

HUMPHREYS & GLASGOW,

BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

38 VICTORIA STREET, London S.W., England.

CONSULTING GAS AND ELECTRIC LIGHT ENGINEERS.

PROPERTIES PURCHASED.

COMPLETE EXAMINATIONS MADE.

R. D. WOOD & CO.,

400 CHESTNUT ST., PHILADELPHIA,

MANUFACTURERS OF

Cast Iron Pipe.

HEAVY LOAM CASTINGS,

Dunham Specials,

Hydraulic Work,

LAMP POSTS, VALVES, ETC.,

Gas Power Plants with Producers.

BUILDERS OF

Gasholders.

Single, Double and Triple Lifts, with or without Metal Tanks.

PURIFIERS, CONDENSERS, SCRUBBERS, BENCH WORK.

Cutler's Patent Freezing Preventer for Holder Cups.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

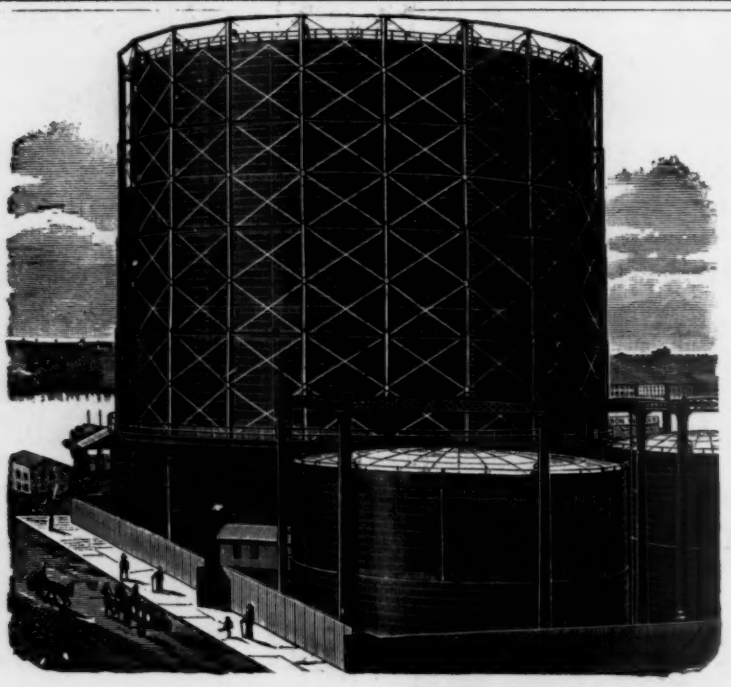
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. —OFFICES— **Bridge & Ogden Sts., Newark, N. J.**



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

THE GAS ENGINEER'S LABORATORY HANDBOOK,

By JOHN HORNBY, F.I.C.

PRICE, - - - - - - - $2.50.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City.

THE STACEY MANUFACTURING CO.,

MANUFACTURERS OF

Gasholders, Steel Tanks,

AND ALL IRONWORK & MACHINERY REQUIRED IN A GAS PLANT.

ALSO THE ONLY AUTHORIZED MANUFACTURERS OF

The Chollar System of Gas Purification.

OFFICES:

No. 239 Mill Street, CINCINNATI, OHIO. 'Phone, West 690.

PLANS, SPECIFICATIONS AND ESTIMATES CHEERFULLY FURNISHED.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WM. HENRY WHITE,

EDISON BUILDING, No. 44 BROAD STREET, = = = NEW YORK CITY.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

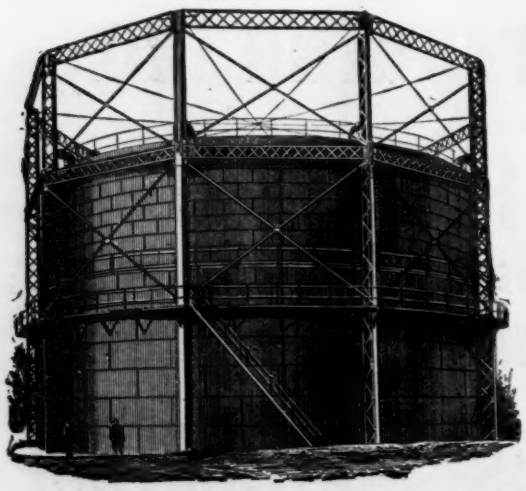
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited
Plans and Estimates Furnished.

1902 DIRECTORY 1902

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 42 Pine Street, New York.



1842 ※ Deily & Fowler, ※ 1903

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu.Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete with Steel Tanks.

BENCHES, SCRUBBERS,

CONDENSERS,

PURIFIERS, IRON ROOFS,

Self-Sealing Retort Lids,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for Complete Works.

ALSO, SOLE MANUFACTURERS OF

C. W. BLODGET'S

HOT GAS SCRUBBER.

Gas Analyst's Manual,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates.

Bound in Handsome Half Leather. Price, - $6.50.

FOR SALE BY

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 120,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

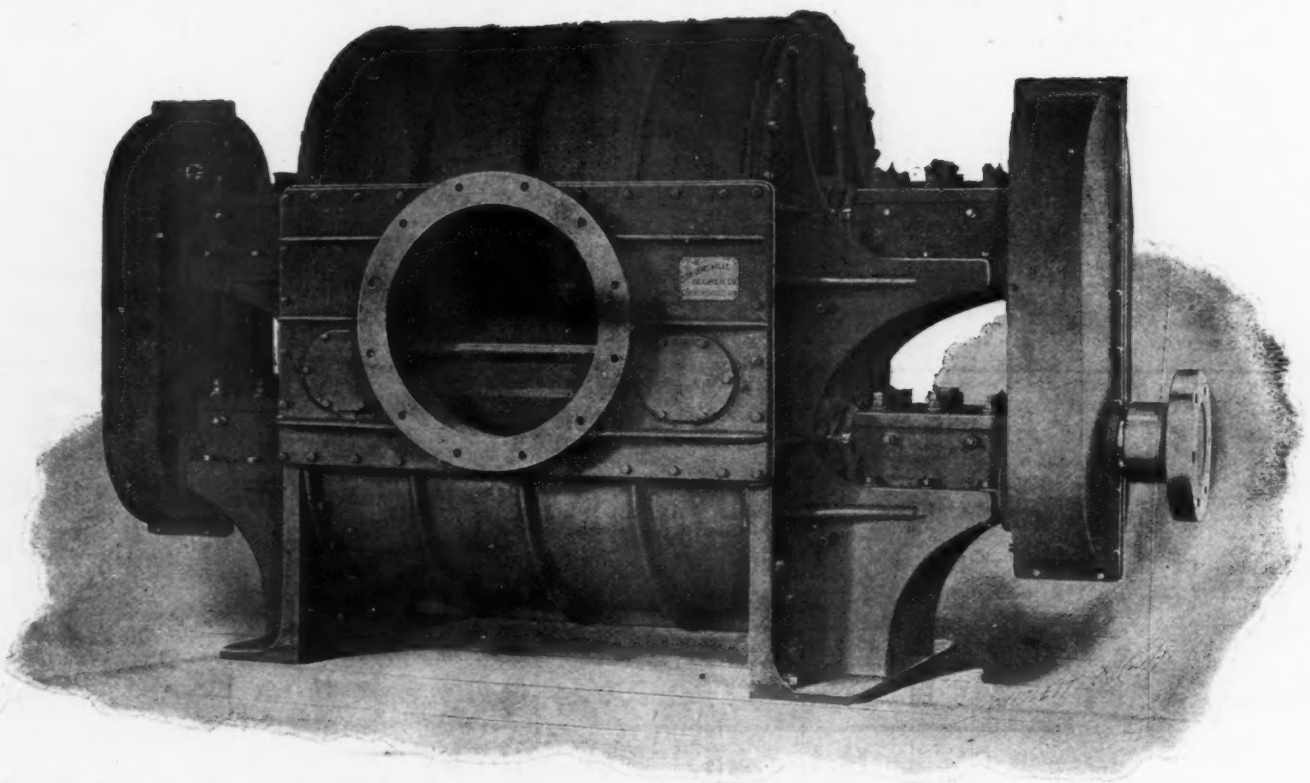
Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | Jefferson and Monroe Streets, CHICAGO.

THE CONNERSVILLE BLOWER CO.,

MANUFACTURER OF

ROTARY POSITIVE PRESSURE GAS EXHAUSTERS, BLOWERS AND PUMPS.



HORIZONTAL OR VERTICAL, IN CAPACITY RANGING FROM 9,000 to 1,800,000 CU. FEET DISPLACEMENT PER HOUR.

CONNERSVILLE BLOWER CO., Connersville, Ind. EASTERN SALES OFFICE: 95-97 Liberty St., New York City.

NATHANIEL TUFTS METER CO.,

ESTABLISHED 1849.

8 MEDFORD STREET, BOSTON, MASS.

Consumers' Dry Gas Meters.
Station Meters of Any Capacity.

PREPAYMENT GAS METERS.

MARYLAND METER CO.,

BALTIMORE, North and Saratoga Streets. CHICAGO, 88 to 92 Jackson Boulevard.

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

USING KEYSTONE METERS

IS FRAUGHT WITH NO DISAPPOINTMENTS.

PERFECTLY MADE.

PERFECT MEASUREMENT GUARANTEED.

THE KEYSTONE METER COMPANY,

ROYERSFORD, PA.

FIELD'S ANALYSIS

For the Year 1902.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 33d Year of Publication. Compiled and Arranged by

JOHN W. FIELD,

Secretary and General Manager of The Gas Light and Coke Company, London.

Price $5. For Sale by

A. M. CALLENDER & CO., - No. 42 Pine Street, N. Y. City.

AMERICAN METER COMPANY,

NEW YORK, PHILADELPHIA, CHICAGO
SAN FRANCISCO, ST. LOUIS.

PREPAYMENT METERS.

THEIR CONSTRUCTION IS SUCH THAT THEY MAY BE READILY READJUSTED WHEN THE SCALE OF GAS RATES IS CHANGED.

HELME & McILHENNY,

Established 1848. 1339 to 1349 Cherry Street, Philadelphia, Pa

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

THEODORE D. BUHL, President. CHARLES H. JACOBS, Secretary-Treasurer.

Detroit Meter Company,

DETROIT, MICH.

Manufacturers of . .

GAS METERS of the HIGHEST QUALITY

METER REPAIRING A SPECIALTY. SEND FOR OUR PRICE LIST.

Detroit is one of the best shipping points in the United States for prompt deliveries by rail or water to the East, West or South.

BUHL Meters will need few Repairs. We make our own Tin Plate. Trial Orders Solicited.

Competition's the stuff that makes us grow!

Hadn't you noticed that we're doing a bigger business than we ever did before?

It Surely Is A Fact!

"WESTERN GAS" MACHINES ARE BUILT TO MEET THE DEMANDS OF MODERN GAS ENGINEERING.

WESTERN GAS CONSTRUCTION CO.,
GAS ENGINEERS AND BUILDERS,
FORT WAYNE, IND.